

Appendix D

Sample Scopes of Work and Guide Specifications for Topographic Surveying Services

D-1. General

This appendix contains sample scopes of work, technical specifications, and guide specifications for performing topographic surveys on military and civil works projects, as listed below. These specifications are intended to provide general guidance if one is developing criteria for a similar project. Portions or combinations of these sample specifications may be extracted to develop specific technical specifications. Sample specifications are provided for general IDC task orders; however, the last section contains a guide specification for use in preparing the overall Architect-Engineer (A-E) Indefinite Delivery Contracts (IDC). A typical state DOT topographic specification is also included at section D-7.

D-2. Generic Topographic Survey Specifications for a Task Order (Military Project)

D-3. Technical Specifications for Topographic and Cadastral Surveys of Storm Water Treatment Area. Consolidated Everglades Restoration Project--Indian River Lagoon (Jacksonville District)

D-4. Scope of Work for Topographic Survey of Dining Facility/Modularity Temporary Facilities (Site and Utility Work), Ft. Hood, Texas-- (Ft. Worth District)

D-5. Technical Specifications for a Topographic Survey of a Scour Erosion Area (Tulsa District)

D-6. Jacksonville District Plane Table Topographic Survey Specifications (1989)

D-7. Typical State DOT Control and Topographic Survey Specification (Florida Department of Transportation)

D-8. Guide Specification for Developing a Topographic Surveying Indefinite Delivery Contract

D-2. Generic Topographic Survey Specifications for a Task Order (Military Project)

The following specification is representative of those written for detailed site plan surveys of a proposed construction project on a military installation.

**DETAILED SPECIFICATIONS
SITE PLAN TOPOGRAPHIC SURVEYS AND UTILITY MAPPING
CONTRACT NUMBER DACWXX-_____
TASK ORDER NO. _____**

1. PROJECT: Commissary Renovation Project
2. LOCATION: Fort Swampy, Huntsville, Alabama
3. GENERAL: Perform field topographic, planimetric, and utility surveys, office computations, and 3D digital mapping for use in developing construction Plans and Specifications for subject project, as detailed in this scope of work.
4. SPECIFIC REQUIREMENTS:
 - a. Horizontal control for the project shall comply with Corps of Engineers Third-Order standards as outlined in EM 1110-1-1005.
 - b. Vertical control shall be Fourth-Order per EM 1110-1-1005.
 - c. Using control (NAD 83 and NGVD 29) provided by the Government, the Contractor shall lay out horizontal and vertical control in project areas using standard total station traverse and differential leveling survey methods. Control points shall be semi-permanent (re-bar w/cap) and set in a manner that they can be used for layout during construction. From said control points, the Contractor shall acquire field topographic (cross-sections or random topo) and planimetric information (buildings, roads, parking areas, sidewalks, fence lines, structures, drainage, etc.) to be used for 40 scale mapping with a one (1) foot contour interval. Density of field elevations shall support 1" = 40' mapping and shall be provided as necessary to show all breaks in grade or changes in terrain. Also the Contractor shall locate and tie individual trees (size and species) in the project area. All elevations shall be taken to the hundredth of a foot. All horizontal and vertical data will be collected with an electronic data collector using the Government- furnished data collection codes. This will include setups, backsights, measure ups, shot numbers, and shot descriptions. The Contractor shall record supplemental descriptive data in a standard field book. The Contractor shall furnish the Government the raw data collector field files (collection and the edited and compiled field file) along with the final coordinate file for all work. Vertical control for utilities shall be taken with a total station instrument, with measure downs for the invert elevations. All vertical control for utilities shall be recorded in field along with any sketches required. Utility information is required for the following:
 - (1) Water - Locate all valves, standpipes, regulators, etc. Locate all fire hydrants. Provide an elevation on top of valve case and top of valve. Provide size of pipe and distance above ground for standpipes.
 - (2) Sanitary Sewer - Locate all manholes and provide top of rim elevation along with an invert elevation of all pipes connected to the manhole. Identify type, size, and direction of each pipe.
 - (3) Storm Drainage - Locate manholes and all other storm drainage structures such as culverts, headwalls, catch basins, and clean-outs. Provide top of manhole or top of catch basin elevation along with an invert elevation of all pipes connected to a manhole or catch basin and bottom elevation. Identify type, size, and direction of each pipe. Provide type, size, and invert elevation for all culverts.

(4) Electrical - Locate all power poles, guy wires, vaults, manholes, meters, transformers, electrical boxes, and substations. Obtain type and height of poles, number and size of transformers, number of crossarms, number of wires (electrical and communication), direction and low wire elevation at each pole. Provide top of rim or top of vault elevation, top of wire or conduit elevation, direction and bottom elevation of manholes and vaults. Provide size for all electrical vaults and boxes.

(5) Gas - Locate all valves, meters, and gas line markers. Provide elevation on top of valve case and on top of valve.

(6) Telephone - Locate all poles, manholes, boxes, etc. Provide top of rim elevation, top of wire or conduit elevation, direction and bottom of manhole elevation. Obtain type and height of poles, number of crossarms, number of wires and low wire elevation at each pole.

(7) Street Light - Locate all poles and provide type and height of poles. Identify number and type of lights on poles. If connected by wires, show direction and low wire elevation.

(8) Heating - Locate all steam manholes and vaults, filler pipes, underground fuel tanks, etc. Provide top of rim or top of vault elevation, top of pipe elevation, direction and bottom of pit elevation. Provide size of vault and all pipe sizes within manhole or vault.

(9) Fire Alarm - Locate any fire alarm systems (box with number), telephones (box with number), etc. in project.

d. All computations are to be arranged in a sequential and understandable order, with notes when appropriate so a review can be made with minimum reconstruction. The Contractor shall furnish the Government computer output of unadjusted bearings, azimuths, distances, and coordinates of all traverse points. The error of closure, both azimuth and positions, shall be shown. Final data will be adjusted by the compass method and will show the adjusted bearings, distances, and coordinates of all points surveyed. The Contractor shall provide a final list of coordinates for all points. The Contractor shall use the combined grid factor for all work. All level lines shall be reduced and adjusted in accordance with accepted procedures and practices. All computations shall be fastened into an 8-1/2" X 11" folder separated and labeled to indicate various facets of work (horizontal, vertical).

e. Field note books standards:

(1) Field books shall be in pencil, and neat, legible, and sequential. They will also show names of crew members and date at the beginning of each day.

(2) Each field book shall have an index. The serial number and type of instruments used will be shown on this page.

f. Target computer system. The Contractor shall provide interactive graphic and nongraphic data files that are fully operational on a computer system running MicroStation software, version X.X or better. The files shall be created using Government-furnished seed files to ensure compatibility with mapping procedures and standards.

g. Utility information. All utilities that are field tied shall be merged into the Government-furnished 1" = 40' topographic database. This includes showing manholes, valves, power poles, etc., and connecting lines. Also the attribute information (text) for each utility shall be placed in the data file. This can include but not be limited to top of rim elevations, invert elevations, pipe size, direction, top of valve elevation, etc. (See Government-furnished example.) All horizontal and vertical control established for ties shall be shown as a symbol with annotation. Also, see Appendix A to this specification for breakdown of level assignments, level symbology, and text size.

h. Map symbols. All symbols shall conform with Government-furnished cell file (CIVSUR.CEL). See Appendix B to this specification for complete breakdown of cells.

i. Global origin. The Contractor shall use the standard global origin of zero "X" and "Y" coordinates at the lower left corner of the X-Y plane.

j. Views. Only view one (1) and five (5) will be active. All locks will be off except keypoint snap and all displays will be on except text nodes and grid.

k. Text/Font. Most map features constitute either graphics or text and are on separate levels. However, in some cases, text will be placed on the same level as the graphics. Examples of this would be the "S" embedded in the line for sanitary sewer or the "W" in the line for water. Font 24 shall be used for utility descriptions and font 127 for all remaining text. See Appendix A for breakdown of level assignments, level symbology, and text size.

5. SPECIAL REQUIREMENTS:

a. There shall be no cutting of trees, and brush cutting shall be kept to a minimum.

b. Excessive marking with paint, flagging, etc. will be avoided.

c. The Contractor shall comply with all applicable safety regulations of the current U.S. Army Corps of Engineers Safety and Health requirements manual EM 385-1-1, and shall acquaint himself and his personnel with the safety requirements governing the area in which the work is being done.

6. MATERIAL TO BE FURNISHED CONTRACTOR:

a. As-built utility maps (1" = 40') as required for areas of work.

(1) Storm drainage

(2) Sanitary sewer

(3) Water

(4) Electrical

(5) Street lighting

(6) Telephone

(7) Gas

(8) Fire alarm

(9) Heating

b. Control listing and map.

c. Collection Point Codes, font library (FONTLIB.NPS), cell file (CIVSUR.CEL), and seed file (SEED.DGN).

d. Field book example.

e. Final product example (1" = 40' plot).

f. Appendix A, Level Assignments and Symbology.

7. REVIEW/SUBMITTAL:

a. Initial submittal - The Contractor shall provide the Government one (1) completed design file and hard copy at 1" = 40' for review to assure compliance with project specifications. The Government reserves a period of five (5) calendar days to comment on this submittal.

b. Pre-final submittal - The Contractor shall generate 3D graphic files of utility data (MicroStation design files) and a 1" = 40' plot of all files for all areas. Digital data shall be supplied on DC/DVD media. The Government reserves a period of ten (10) calendar days to comment on Contractor's work.

c. Final submittal - The final submittal shall contain all the revisions required as a result of the Government's prefinal review. The final submittal shall consist of:

- (1) MicroStation design files on CD/DVD format
- (2) 1" = 40' hard-copy plots of individual data files
- (3) All items in paragraph 6 above
- (4) All computations (in folder)
- (5) All field books (reduced and checked)
- (6) CD/DVD containing raw field data and final coordinate data

8. REPORTS: The Contractor shall submit monthly progress status reports during the duration of the project.

9. SCHEDULE AND DELIVERY: The submission schedule shall commence on the day notice-to-proceed is issued and will run consecutively for the number of days shown in Appendix B. All submittals shall be accompanied by a letter of transmittal.

Enclosures:

Appendix A

Appendix B

(Appendices to be included in an actual scope of work.)

D-3. Technical Specifications for Topographic and Cadastral Surveys of Storm Water Treatment Area. Consolidated Everglades Restoration Project--Indian River Lagoon (Jacksonville District)

This technical scope involves a comprehensive topographic and planimetric survey of four sections (2,560 acres) of land situated in Indian River County, Florida. The entire area consists of 15 to 20 ft high orange and grapefruit orchards, and contains access roads, irrigation canals, and related pump systems. Both RTK and robotic total stations were used for these surveys. On this project, a robotic total station was set up atop a portable 25-ft triangulation tower, from which shots to a 20 ft prism rod cleared the tops of the orange trees. The following scope of work was developed by the Jacksonville District Survey Section and the work was performed under an IDC task order.

TECHNICAL QUALITY CONTROL REQUIREMENTS
PLANS AND SPECIFICATIONS SURVEY
CERP INDIAN RIVER LAGOON - SOUTH
C-23/24 STORM WATER TREATMENT AREA (STA)
ST. LUCIE, COUNTY, FORT PIERCE, FLORIDA
MAY 12, 2004, SURVEY 04-059

1. LOCATION OF WORK. *The work is located in the vicinity of Ft. Pierce, Florida, more specifically, the South half of Section 26, the South half of Section 27, and Sections 33, 34, and 35 all in Township 35 South, Range 38 East, Tallahassee Meridian. In addition, this survey will include the portion of C-24 canal that runs adjacent to Section 33, the portion of State Route 609 that is adjacent to the South half of Section 26 and Section 35, and the portion of State Route 613 between Sections 33 and 34, and is adjacent to the South half of Section 27.*

2. SCOPE OF WORK.

a. *Perform a complete cadastral and topographic survey of the Indian River Lagoon – South, C-23/24 Storm Water Treatment Area (STA), as outlined herein, on the enclosures and in the furnished CADD data. The purpose of this survey is to obtain data for the preparation of the plans and specifications for the subject project.*

b. *The services to be rendered by the contractor include all the work described in these technical requirements. Details not specifically described in these instructions are nevertheless a firm requirement if they can be identified as an item, or items, commonly a part of professional grade work of a comparative nature.*

c. *The contractor shall furnish all necessary materials, labor, supervision, equipment, and transportation necessary to execute and complete all work required by these specifications.*

d. *The Corps of Engineers, Survey Section shall be contacted the same day that the contractor plans to commence the work. The POC for this project is Jeffrey Navaille at (904) 232-2499.*

e. *A picture ID showing company name, date of birth, and driver's license number must be carried by personnel working on USACE projects.*

f. *Rights-of-Entry must be obtained verbally and recorded in the field book before entering private property. Enter the name and address of the property owner contacted.*

g. All Surveying and Mapping products and related work shall be in strict compliance with the applicable Engineering Manuals and with related technical standards and publications: (online at <http://www.usace.army.mil/publications/>)

- EM-1110-1-1000
- EM 1110-1-1002
- EM-1110-1-1005
- EM-1110-2-1003
- EM-1110-1-2909
- Tri-Services A/E/C CADD Standards, Spatial Data Standards and related Spatial Data Products
- Florida Statutes Chapter 177 (Parts I, II, and III), Chapter 472 (Land Surveying), and Rule Chapter 61G17-6, Florida Administrative Code (Minimum Technical Standards for Surveys).
- Bureau of Land Management Manual of Surveying Instructions, 1973 edition.
- Restoration of Lost or Obliterated Corners and Subdivision of Sections. (Bureau of Land Management).

h. Digital Geospatial Metadata. Metadata are "data about data." They describe the content, identification, data quality, spatial data organization, spatial reference, entity and attribute information, distribution, metadata reference, and other characteristics of data. Each survey project shall have metadata submitted with the final data submittal. All metadata submitted must be compliant with the Federal Geographic Data Committee Standard "Content Standard for Digital Geospatial Metadata," FGDC-STD-001-1998. This standard is available for download from www.fgdc.gov. A graphical, annotated workbook explaining the standard is available in PDF format at www.fgdc.gov. Furnish a digital file using Corpsmet95 Metadata Software. Corpsmet95 is available for download from www.corpsgeo1.usace.army.mil. All sections applicable to this collection effort must be completed. The point of contact in Survey Section for questions about metadata is Mr. Bill Mihalik at 904-232-1462.

i. The digital data shall be submitted on Recordable (CD-R) Compact Disk, media. Compact Disk, Rewritable (CD-RW) will not be accepted.

3. FIELD SURVEY EFFORT. The area of work is outlined on Enclosure 1: quad map, Enclosure 2: technical requirements, and Enclosure 3: control monument descriptions. This information will also be placed on the rocknet ftp site under pub/survey/fsi/04-059.

a. CONTROL. The base project control network (monumentation) must be referenced to the North American Datum 1983 (NAD 83/99) for a horizontal reference and both the North American Vertical Datum, 1988 (NAVD 88) and the National Geodetic Vertical Datum, 1929 (NGVD29) for a vertical reference. All control surveys shall be Third Order, Class II accuracy. The datums for the final mapping product shall be NAD83(99) and NAVD88.

(1) The basic control network may be accomplished using precise differential carrier-phase Global Positioning System (GPS) observations. Differential GPS baseline vector observations shall be made in strict accordance with the criteria contained in the engineering manual EM-1110-1-1003 and with the Geometric Geodetic Accuracy Standards and Specifications for Using GPS Relative Positioning Techniques as directed by the Federal Geodetic Control Committee, version 5.0.

(2) Network design, station and baseline occupation requirements, for static and kinematic (see para. 3a8.) surveys, satellite observation time per baseline, baseline redundancies, and connection requirements to existing networks, shall follow the criteria given in the above said engineering manual. A field observation log shall be completed at each setup in the field.

(3) GPS derived elevation data shall be supplied in reference to the above said datum. Existing benchmark data and stations shall be used in tandem in a minimally constrained adjustment program to model the geoid. All supporting data used in vertical adjustment shall be submitted. The GPS plan shall be submitted and approved by Mr. Jeffrey Navaille prior to commencing work.

(4) The GPS network shall commence from the control shown on Enclosure 3. All established or recovered control shall be fully described and entered in a FIELD BOOK, in accordance with the Technical Requirements of this contract. All control surveys shall be Third Order, Class II accuracy. The contractor shall submit the field data and abstracts for the control networks to Survey Section for review before commencing the mapping. The monument designations shall be furnished as requested.

(5) All horizontal and vertical control (double run forward and back) established shall be a closed traverse or level loop with no spur lines, and meeting third order accuracy. All horizontal and vertical control along with baseline layouts, sketches, and pertinent data shall be entered in field books.

(6) All monuments, survey markers, etc., recovered shall be noted on the copies of control descriptions. Control points established or recovered with no description or out-of-date (5 Years old) descriptions shall be described with sketches for future recovery use.

(7) All original field notes shall be kept in standard, pocket size, field books and shall become the property of the Government. The first four pages of the field books shall be reserved for indexing and the binding outside edge shall be free from all marking.

(8) REAL TIME KINEMATIC (RTK). Any contractor intending to utilize RTK will notify the COE prior to negotiation. The COE will provide technical requirements and will require a detailed survey plan from the contractor.

b. TOPOGRAPHIC DATA. It is requested that a comprehensive topographic survey be performed on the subject site. Observations shall be taken at a minimum frequency of 100-feet. The coverage and level of detail desired shall be such that a one-foot contour interval can be displayed from the resulting digital terrain model.

c. PLANIMETRIC DATA. All features within the survey limits (weirs, culverts, buildings, vegetation, roads, RR, debris, fence lines, structures, drainage, wells, etc.) shall be located. Provide detailed information on all features that would affect construction, i.e. invert elevation of outflow pipe, diameter of pipe, waterside length of pipe to discharge, invert elevation of pipe at discharge, elevations of top of weirs and define existing edge of water and vegetation/tree lines. Individual citrus trees do not need to be located. Trees of significant size on hammocks should be identified.

d. UTILITY INFORMATION. Locate and obtain basic information of any utilities (water, sewer, drainage, electrical, commutation, etc.) within the survey limits or nearby that would interfere with construction. Locate and detail culverts, above and below ground utilities (including pole locations and low wire elevations for high voltage transmission wires running parallel to the C-24 canal), above and below ground irrigation systems, fences, and all other structures.

e. BREAK LINES. Break lines shall be located for all natural or man-made features as needed. These include but are not limited to road edges, tops and toes of ditches and canals, and levee features. Any condition where a change in grade can be detected should be located. The break lines shall be located by X, Y, and Z coordinates and identified.

f. CADASTRAL DATA. Perform research and locate the necessary cadastral features in the project area to delineate and isolate areas that may be impacted by construction or other operations. Locate the exterior section boundaries of the lands described in the "Location of Work" portion of this document. Detailed individual parcel surveys are not required. Obtain data on the Rights-of-Way for all roads and for the C-24 canal. Also locate and delineate easements of record such that a final working area may be derived for project planning and execution.

4. DATA PROCESSING. The contractor shall make the necessary computations to verify the correctness of all measurements and apply the proper theory of location in accordance with the law or precedent and publish the results of the survey. The contractor shall submit advance copies of the

horizontal control so that the USACE can review. Compute and tabulate the horizontal and vertical positions on all work performed. Review and edit all field data for discrepancies before plotting the final drawings.

5. CADD. The survey data shall be translated or digitally captured into Bentley MicroStation J 3-D design files according to the specifications furnished. The survey data (cover, control, site plan, plan sheets, and section drawings) shall be provided in Bentley MicroStation J 3-D format. The neat mapping area on all sheets (covers and plans) shall be 30-inches by 25-inches.

a. GLOBAL ORIGIN. The Bentley MicroStation J 3-D design file shall be prepared with a global origin of 0, 0, 2147483.65, Design file master units: feet (Ft), sub units: thousands of a foot (Th.), sub per master: 1,000, and positional units per sub: 1. The file name shall be the survey number prefixed to an "f," i.e., f059S1.dgn. All reference files shall commence with the f059 prefix as well.

b. DIGITAL TERRAIN MODEL (DTM) DATA. The contractor shall develop and deliver a surface model for the entire survey area using Bentley Inroads SelectCAD compatible Digital Terrain Modeling software. The model file shall have the .dtm extension. The digital terrain model shall be developed from cross sections, spot elevations, and breaklines (when applicable). Breaklines should include ridges, drainage, road edges, surface water boundaries, and other linear features implying a change in slope. The surface model shall be of adequate density and quality to produce a one-foot contour interval derived from the original DTM (Digital Terrain Model) file. The contour data shall be incorporated as a reference file into the final data set. All data used to develop the DTM's shall be delivered in Bentley MicroStation J 3-D design files. The contours shall be developed in the digital terrain model (DTM). The contours shall be provided in one or more master database DGN files attached as a reference file to all sheets files utilizing the clip bounds methods. Each contour shall be drawn sharp and clear as a continuous solid line, dashed contours are not acceptable. Every index contour shall be accentuated as a heavier line than the intermediate and shall be annotated according to its actual elevation above datum. Whenever index contours are closer than one-quarter (1/4) inch, and the ground slope is uniform, the intermediate shall be omitted. Labeling or numbering of contours shall be placed on top of the contour line, so that the elevation is readily discernible, do not break contours. Labeling of intermediate contours may be required in areas of low relief.

c. MASTER DGN FILES.

(1) The survey data (DTM data points) points shall be provided in one or more master DGN file, attached as a reference file to all sheet files utilizing the clip bounds methods.

(2) The contours shall be provided in one or more master DGN files, attached as a reference file to all sheet files utilizing the clip bounds methods.

(3) The control and baselines shall be provided in one or more master DGN file, attached as a reference file to all sheet files utilizing the clip bounds methods.

(4) The planimetric detail, channel limits, and alignments shall be provided in one or more master DGN file, attached as a reference file to all sheet files utilizing the clip bounds methods.

(5) The breaklines shall be provided in one or more master DGN file, attached as a reference file to all sheet files utilizing the clip bounds methods DO NOT PLOT THE BREAKLINES.

(6) The cadastral data shall be depicted in one or more master DGN files, attached as a reference file to all sheet files utilizing the clip bounds methods. Show ROW points of intersection (PI) with corresponding X and Y coordinates in table format. Show section and property corners with X and Y coordinates in table format. Label bearings and distances on Section lines.

d. COVER AND CONTROL SHEET. The first sheet shall be the cover sheet to a scale that shows the survey limits in relationship to surrounding metro areas and access roads to site. In addition,

show the control sketch, survey control tabulation, sheet layout or index, legend, project location map, survey notes, north arrow, graphic scale, grid ticks, and large signature block. Tabulate, plot, and list the horizontal control used for the survey on the final drawings.

e. PLAN SHEETS. The plan sheets shall be prepared, to a scale of 1" = 100', in the Corps of Engineers format showing notes, title block, grid, north arrow, graphic scale, legend, sheet index, and D. O. File Number. The second sheet and all sheets following shall be a continuation sheet and shall have a minimum of two notes, note 1: See Drawing number 1 for notes, note 2: Refer to Survey No. 04-059.

f. TITLE BLOCKS. Standard title blocks shall be provided by the COE. Cell libraries are available on the District's home page and ftp site.

g. SECTION VIEWS. No section views are required per this survey.

h. FEATURE DETAIL VIEWS. Show, at an appropriate scale, any other needed feature detail within the survey limits.

6. MAP CONTENT.

a. COORDINATE GRID. Grid ticks (English) of the applicable State Plane Coordinate System shall be properly annotated at the top, bottom, and both sides of each sheet. Spacing of the grid ticks shall be five (5) inches apart.

b. CONTROL. All horizontal and vertical ground control monuments shall be shown on the maps in plan and tabulated. Aerotriangulation points (if applicable) shall be furnished if requested in digital form.

c. PLANIMETRIC. The maps shall contain all surface-visible land use, structural, and planimetric features which are visible or identifiable.

d. MAP EDIT. All names, labels, notes, and map information shall be checked for accuracy and completeness. All commercial buildings, roads, and man made features shall be labeled with purpose and name.

e. SHEET INDEX AND LEGEND. On plan drawings a small-scale sheet index shall be shown on each sheet of the series; highlighting the sheets in the standard manner. Planimetric and topographic feature legends shall be shown on each sheet. Contractor logo shall be shown on each drawing.

7. OFFICE REVIEW AND COMPUTATIONS. The contractor shall make the necessary computations to verify the correctness of all measurements and apply the proper theory of location in accordance with the law or precedent and publish the results of the survey. The contractor shall submit the original field notes and horizontal and vertical abstract (computation abstract) to Survey Section for review before mapping commences.

8. CONTRACTOR QUALITY CONTROL/GOVERNMENT QUALITY ASSURANCE.

The contractor is responsible for quality control. Government personnel may perform inspections of the contractor's field operations at any time during the prosecution of this work. The contractor shall explain calibration procedures and operational activities related to their field effort. If during the Government's review of the contractor's products it becomes apparent that little or no review has been done, the Government will return the entire project to the contractor for correction.

a. SURVEY/QUALITY CONTROL REPORT. The contractor shall furnish a digital (*.doc) file on the final CD. The report shall include Right-of-Entry information, descriptive text regarding control monuments recovered, destroyed, or reset included in the control network, tide gage location and monument used, dates of field survey collection, types of equipment used, quality control checks, and digital files. Unique circumstances and/or issues related to this survey, general approach/methodology to

this survey. Along with any other data required in accordance with the law or precedent and for the Corps of Engineers to publish the results of the survey.

9. DELIVERIES. On completion, all data required shall be delivered or mailed to Design Branch, Survey Section at the address shown in the contract, and shall be accompanied by a properly numbered, dated and signed letter or shipping form, in duplicate, listing the materials being transmitted. All digital data shall be submitted on CD-ROMs. All costs of deliveries shall be borne by the contractor. Items to be delivered include, but are not limited to the following:

- GPS network plan, (before GPS work commences).
 - GPS raw data along with field observation log sheets filled out in field with all information and sketches.
 - Raw data and computation files with horizontal and vertical abstracts along with any Q1 and Q2 files.
 - Digital survey/quality control report, including abstracts, computations, adjustments, and tabular summaries fully annotated with independent checks.
 - Field books.
 - Scanned field books (in adobe acrobat pdf format, one field book per file).
 - Furnish an ASCII file containing all data in the following format : X, Y, Z, and Descriptor.
 - If HYPACK software is utilized the HYPACK line files shall be provided to the COE on compact disk.
 - DGN and DTM files.
 - Advance paper plots (2 sets).
 - Metadata files (*.gen and *.met files).
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**D-4. Scope of Work for Topographic Survey of Dining Facility/Modularity Temporary Facilities (Site and Utility Work), Ft. Hood, Texas--
(Ft. Worth District)**

This appendix illustrates a scope of work for 1 inch = 30 ft scale topographic mapping and extensive utility detailing. This scope was developed by the Ft. Worth District for work to be issued under an IDC Task Order.

CESWF-EC-DC

15 Sept 2004

MEMORANDUM FOR CESWF-PER-PE
ATTN: Steve Schultz

SUBJECT: Request for Services – Fort Hood, Texas
Modularity Temporary Facilities/ Site and Utility Work

1. GENERAL:

Perform field topographic, planimetric, and utility surveys, office computations, and 3D digital mapping for use in developing "Plans and Specifications" as detailed in this scope of work. The areas to be surveyed are identified on the attached drawings. Hatching on the attached drawings indicates the limits of the areas to be surveyed.

2. SPECIFIC REQUIREMENTS:

a. *Horizontal and Vertical control for the project shall comply with Corps of Engineers standards as outlined in EM 1110-1-1005. Horizontal control shall be based on Texas State Plane Coordinate System, Central Zone, NAD-83. Vertical control shall be based on NGVD-29. Use English units.*

b. *Use the control points previously provided by the Government for the Dining Facility survey. The contractor shall layout horizontal and vertical control in the identified project areas. A minimum of 5 control points shall be provided for each area surveyed. Control points shall be semi-permanent (rebar w/cap) and set in a manner that they can be used for layout during construction. The Contractor shall acquire field topographic (cross-sections or random topo) and planimetric information (buildings, roads, parking areas, sidewalks, fence lines, structures, drainage, etc.) to be used for 1" = 30' scale mapping with a 1-foot contour interval. Density of field elevations shall support 1" = 30' mapping and shall be provided as necessary to show all breaks in grade or changes in terrain. Also the Contractor shall locate and tie individual trees (size and species) in the project area. All elevations shall be taken to hundredths of a foot accuracy. All horizontal and vertical data will be collected with an electronic data collector. The Contractor shall record data in the field book. This will include setups, backsights, measure ups, shot numbers, and shot descriptions. The Contractor shall furnish the Government the field files (collection and the edited and compiled field file) along with the final coordinate file for all work. All applicable survey features and utility information shall be placed in the files mentioned below. Vertical control for utilities shall be taken with a total station instrument, with measure downs for the invert elevations. All vertical control for utilities shall be recorded in the field book along with any sketches required. Utility information is required for the following:*

Water - Locate all valves, standpipes, regulators, etc. Locate all fire hydrants. Provide an elevation on top of valve case and top of valve. Provide size of pipe and distance above ground for

*standpipes. Locate all underground water lines, pipe sizes, and locations. Place all water utility information in a CADD file named **fh062530-V-wa----.dgn**.*

*Sanitary Sewer - Locate all manholes and provide top of rim elevation along with an invert elevation of all pipes connected to the manhole. Identify type, size, and direction of each pipe. Locate all clean-outs. Locate all Sanitary Sewer lines, pipe sizes. Provide distance to and top rim and invert for manholes or sanitary sewer structures at least one structure upstream and downstream for sanitary sewer lines that extend outside the cross-hatched or area identified to be surveyed. Place all sanitary sewer utility information in a CADD file named **fh062530-V-ss----.dgn**.*

*Industrial Waste - Locate all manholes and provide top of rim elevation along with an invert elevation of all pipes connected to the manhole. Identify type, size, and direction of each pipe. Locate all clean-outs. Locate all Industrial Waste lines, pipe sizes. Provide distance to and top rim and invert for manholes or Industrial Waste structures at least one structure upstream and downstream for Industrial Waste lines that extend outside the cross-hatched or area identified to be surveyed. Place all industrial waste utility information in a CADD file named **fh062530-V-iw----.dgn**.*

*Storm Drainage - Locate manholes and all other storm drainage structures such as culverts, headwalls, catch basins, and clean-outs. Provide top of manhole or top of catch basin elevation along with an invert elevation of all pipes connected to a manhole or catch basin and bottom elevation. Identify type, size, and direction of each pipe. Provide type, size, and invert elevation for all culverts. If only one structure on a gravity flow line falls within the hatched area shown on the drawing, provide distance and invert data for one structure both upstream and downstream of the site. Place all storm drainage utility information in a CADD file named **fh062530-V-st----.dgn**.*

*Electrical and Communication - Locate all power poles, guy wires, vaults, manholes, meters, transformers, electrical boxes, and substations. Obtain type and height of poles, number and size of transformers, number of conductors on each pole, including telephone and cable TV, number of cross arms, number of wires (electrical and communication), direction and low wire elevation at each pole. Provide top of rim or top of vault elevation, top of wire or conduit elevation, direction and bottom elevation of manholes and vaults. Provide size for all electrical vaults and boxes identify the size and number of ducts or cables entering each manhole and their invert elevations. Place all electrical utility information in a CADD file named **fh062530-V-eu----.dgn**. Place all communications utility information in a CADD file named **fh062530-V-cp----.dgn**.*

*Gas - Locate all valves, meters, and gas line markers. Provide elevation on top of valve case and on top of valve. Place all natural gas utility information in a CADD file named **fh062530-V-ng----.dgn**.*

*Telephone - Locate all poles, manholes, boxes, etc. Provide top of rim elevation, top of wire or conduit elevation, direction and bottom of manhole elevation. Obtain type and height of poles, number of crossarms, number of wires and low wire elevation at each pole. Place all communications utility information in a CADD file named **fh062530-V---cp.dgn**.*

*Streetlight - Locate all poles and provide type and height of poles. Identify number and type of lights on poles. If connected by wires, show direction and low wire elevation. Place this information in the CADD file **fh062530-V-eu----.dgn**.*

*Heating - Locate all steam manholes and vaults, filler pipes, underground fuel tanks, etc. Provide top of rim or top of vault elevation, top of pipe elevation, direction, and bottom of pit elevation. Provide size of vault and all pipe sizes within manhole or vault. Place all high temperature and chilled water utility information in a CADD file named **fh062530-V-ht----.dgn**.*

*Fire Alarm - Locate any fire alarm systems (box with number), telephones (box with number), etc. in project. Place this information in the CADD file **fh062530-V-cp----.dgn**.*

c. All computations are to be arranged in a sequential and understandable order, with notes when appropriate so a review can be made with minimum reconstruction. The Contractor shall furnish the Government computer output of unadjusted bearings, azimuths, distances, and coordinates of all traverse points. The error of closure, both azimuth and positions, shall be shown. Final data will be adjusted by the compass method and will show the adjusted bearings, distances, and coordinates of all points surveyed. The Contractor shall provide a final list of coordinates for all points. All level lines shall be reduced and adjusted in accordance with accepted procedures and practices. All computations shall be fastened into an 8-1/2" X 11" folder separated and labeled to indicate various facets of work (horizontal, vertical).

d. Field note books standards:

- Field books shall be neat, legible, and sequential. They will also show names of crewmembers and date at the beginning of each day. All print and sketches shall be dark enough to produce legible photocopies of each page. Field books shall be scanned into a .pdf file and provided.

- Each field book shall have an index. The serial number and type of instruments used will be shown on this page.

- There is to be a maximum of one (1) horizontal setup per page.

e. Provide topographic survey in the form of a three-dimensional Micro Station graphics file, version 07.01, named **fh062530-v-sp.dgn**. The file shall contain breaklines, triangles, and spot elevations at their correct elevations and any other data required to create an accurate digital terrain model. Breaklines shall be placed at their actual elevation. Planimetric features shall be placed at zero elevation. Use the furnished file (AECvol1.pdf, Appendix A) showing level, color, line code, and weight (line symbology) convention for each graphics file. Working units shall be master units = feet, sub units = none. Resolution: 100 sub units per master unit, 10 positional units per sub unit. The government will provide a Micro Station seed file. (Use the attached Dining Facility survey file: fh023652D-V-spm.dgn as a seed file) Only views one (1) and five (5) will be active. All locks will be off except keypoint snap and all displays will be on except text node and grid. Most map features constitute either graphics or text and are on separate levels. However, in some cases, text will be placed on the same level as the graphics. Examples of this would be the "S" embedded in the line for sanitary sewer or the "W" in the line for water. Font 1 shall be use for all text. Font 3 may be used where applicable.

f. Utility information. All utilities that are field tied shall be placed into the appropriate Micro Station graphics file, as stated above. This includes showing manholes, valves, power poles, etc., and connecting lines. Also the attribute information (text) for each utility shall be placed in the graphics file. This can include but not be limited to top of rim elevation, invert elevations, pipe size, direction, top of valve elevation, etc. All horizontal and vertical control established for ties shall be shown as a symbol with annotation.

- Map symbols. All symbols shall conform to the Government-furnished cell library (surv_sym.cel).

- For buildings or structures provide the type of structure, number of stories or floors, and building number if site is located on a military installation.

- Identify all surfaces, grass, ground cover, concrete, asphalt, etc. for all features including but not limited to roads, streets, driveways, sidewalks, parking areas, airfields, ditch linings, etc.

- Locate and identify the highway right-of-way/base boundary.

- Locate, identify, and describe all fences.

3. SPECIAL REQUIREMENTS:

There shall be no cutting of trees and brush cutting shall be kept to a minimum.

Excessive marking with paint, flagging, etc. will be avoided.

The Contractor shall comply with all applicable safety regulations of the current U.S. Army Corps of Engineers Safety and Health requirements manual EM 385-1-1, and shall acquaint himself and his personnel with the safety requirements governing the area in which the work is being done.

4. MATERIAL TO BE FURNISHED TO THE CONTRACTOR:

Utility maps as required for areas of work. Some of the existing utilities in the project areas are shown on the attached maps. These maps shall be used for reference only. Utility locations shall be field verified with surface features, etc. Additional utility maps can be obtained from the Ft. Hood Department of Public Works (DPW). The Contractor shall be responsible for contacting Ft. Hood DPW for these maps. The following maps are attached:

- *Storm Drainage*
- *Sanitary Sewer*
- *Water*
- *Electrical*
- *Gas*

Control points, benchmarks, and seed file information. Use the attached Dining Facility survey file, fh023652D-V-spm.dgn for the seed file and for control points for this project.

Cell library (surv_sym.cel), and library legend (surv_legend.pdf).

Files and level/layer convention and symbology. See A/E/C CADD Standard (AECvol1.pdf), Appendix A, Surveying/Mapping (pages A8-A23) for level assignments and symbology requirements for the CADD files mentioned in item 2 above.

5. FINAL SUBMITTAL:

Final submittal shall consist of:

- *Micro Station graphics design files specified above of the survey delivered on 3 ½" floppy or CD-ROM.*
- *Plots of survey with spot elevations displayed and without spot elevations displayed at a 1" = 30' scale.*
- *All items in paragraph 2 above.*
- *All computations.*
- *Copies of all field notes / books (checked and reduced) scanned to .pdf files.*
- *All raw field data and final coordinate files.*
- *The government reserves a period of 10 days to review and comment on Contractor's work.*

6. REPORTS:

The contractor shall submit monthly progress status reports during the duration of the project.

7. SCHEDULE AND DELIVERY:

The submission schedule shall commence on the day notice-to-proceed is issued and will run consecutively for the number of days shown in the attached schedule. A letter of transmittal shall accompany all submittals. The final submittal shall be submitted by close of business on 28 Sep 2004.

8. ACCESS TO THE PROJECT SITE: *Contact Lisa Cuellar (Ft. Hood POC, 254-788-2756), at the Ft. Hood DPW office, upon notice-to-proceed to schedule access to the project sites.*

9. FUNDING INFORMATION:

Work Item Number: To be provided

Mark L. Black, P.E.
Chief, Civil Section

Encl
Drawings of areas to be surveyed
Existing Utility Maps
AEC CADD Standards, Vol. 1
Cell Library and Legend
Control Point drawing
Copy furnished John Oblak, Engr. Manager
Micro Station Seed File

D-5. Technical Specifications for a Topographic Survey of a Scour Erosion Area (Tulsa District)

The following technical specifications are representative of a civil project where detailed topographic surveys are required in a scour area.

**CONTRACT NO. DACW56-01-1005
TASK ORDER NO. 0016
TOPOGRAPHIC SURVEY
PAT MAYES LAKE, TEXAS
SCOUR EROSION AREA ALONG SANDERS CREEK (NORTH OF DAM SITE)
08 JAN 03
Rev. 13 JAN 03**

SCOPE OF WORK

1. SCOPE AND LOCATION.

a. The intended purpose of this Task order is to obtain a product defining the topography around the scour area of erosion as shown on Government furnished map. The contractor's effort toward this purpose shall yield total field-to-finish information packages, complete in detail and within the parameters defined by this scope of work, readily available for use by the Government or its agents.

b. The contents of this scope describe specific project requirements to be accomplished under this delivery order and the end product required of the contractor.

2. MATERIALS FURNISHED BY THE GOVERNMENT.

The contractor shall be provided with:

- a. Site map indicating the areas to be surveyed.*
- b. Digital photos of the area to be surveyed.*

3. CHARACTER AND EXTENT.

The general scope of services required of the contractor is outlined below. Specific descriptions and technical requirements pertaining to the work will follow in subsequent sections.

4. SITE SPECIFICS

The site to be surveyed is located north of the Pat Mayse Lake Dam along Sanders Creek, approximately 1,500 north of the exit drain. The site to be surveyed extends from an area 100 feet southwest of the end of rip rap along Sanders Creek to approximately 350' northeast (or 100' northeast of the scoured area). In addition, locations are required from the fence line (on the west) to the toe of slope at the Wildlife Management Area (to the east).

5. FIELD SURVEYING

- a. Survey Control*

(1) Horizontal control shall be established on the Texas State Plane Coordinate System North Zone NAD 83 US Feet (site control may be established using CORS). Control shall be established to meet minimum requirements for 3rd Order, Class I, 1:10,000. Controlling points shall be occupied points of a closed and adjusted traverse that will meet or exceed Third order, Class I, Accuracy of 1:10,000. If more control points are required to be set during the execution of the survey, rebars may be set and should be planted to assure a degree of permanency. All control points set shall also be adequately described and referenced on the digital SWT 598 forms.

(2) Vertical control shall be referenced to the NGVD 29 U.S. Feet. (Date and Time Water Surface Locations can be used). Controlling points shall be established utilizing procedures to meet or exceed Third Order Accuracy Standards. All level lines shall be closed and vertical error adjusted throughout each level loop.

(3) New control stations shall consist of ½" Rebar having a length of 18" with a stamped aluminum cap. Each cap shall be identified by designation and the year set. Each control marker shall be referenced with at least three ties and appropriately described in hardbound field books for future use. Proper care shall be taken when setting any control points and at least a 2' radius around the control marker site shall be checked for the presence of any underground utilities.

b. Topographic survey

Topo shots sufficient to define 1' contour intervals shall be taken as well as spot elevations, all breaklines, dyke areas (top, centerline and toe elevations) and water depth locations (use of a small flat bottom boat will be required; the width of the area to be located by boat is approximately 50' by 150'). An invert elevation of the pipe (with pipe size and material) exiting the dam site shall be located. In addition, cross sections shall be taken at every 25' beginning at a location 50' south of the end of riprap along the Sanders Creek embankment and continuing approximately 50 feet north of the scour area. Cross section locations shall consist of 10' offset west of top of bank, top of bank (W), rock edge (W), toe of slope (W), edge of creek (W), centerline of creek (W), edge of creek (E), toe of slope (E), edge of rock (E), top of slope (E) and offset 10' east of top of bank. In addition, the Corps of Engineers boundary line and corners and fence line along the westerly line of the area in question shall be located. All State and Federal Laws pertaining to the surveying of government boundaries are to be followed in the preparation of this mapping. The contractor shall illustrate the following information on the title block: Project Name, County, State, Coordinate System used, contour interval, date of survey.

c. Survey Data and Deliverables

(1) The finished product shall be delivered in Bentley MicroStation CADD (*.dgn) and *.dtm format. Specifically, they shall be submitted as MicroStation 3D dgn files with working units resolution 1 to 100, Master Units: ', subunits <blank>, global origin GO = 21 474 836.48, 21 474 836.48, 21 474 836.48; furnish one CDROM one MicroStation 3D drawing file showing existing contours and any planimetric features with contours and features at correct elevations; one MicroStation 3D drawing file showing points and breaklines on separate levels and dtm created by or readable by Intergraph Inroads software. The supplied disks shall be clearly labeled to show contractors name and telephone number, map scale, date and file name.

(2) Corpsmet Metadata (FGDC format) file shall be delivered at the completion of the project.

(3) Digital SWT 598 forms (.dgn) shall be provided illustrating at least three reference ties and their general relationship to North and "to reach" descriptions for any new survey control set for the project.

(4) Any field notes, raw data collection files, plottings, etc. used in the execution of the survey work shall be provided.

6. ACCESS TO WORK.

The contractor shall be liable for and save the Government harmless on account of damages to persons or property in the performance of his work. The use of ATV or vehicles on any adjoining properties shall be prohibited, although they will be allowed on Government lands as long as discretion is used. The contractor shall contact the Pat Mayse Lake Office, Paul Gray, Lake Manager at (903) 732-3020 or Jeff Paskin, Park Ranger at (903) 732-3020.

7. SAFETY.

General Safety Requirements. The Contractor shall comply with applicable safety regulations defined in the latest version of the U.S. Army Corps of Engineers Safety and Health Requirements Manual EM 385-1-1, and shall acquaint himself and his personnel with the safety requirements governing the area in which the work is being done. Total man-hours worked by survey and office personnel shall be provided to the project manager at the completion of the project.

8. COMMENCEMENT OF WORK.

The contractor shall be prepared to begin the first full week after award of delivery order unless otherwise directed by the contracting officer.

9. TIME SCHEDULE.

The contractor performance and time of delivery are of utmost importance, and his endeavor toward the project shall be vigorous and continuous until completion. All work shall be completed and final delivery made to the Government within two weeks of execution of this task order.

10. INSPECTION.

The government may elect to perform independent field surveys in order to check and validate the accuracy and adequacy of the submitted data. The government reserves the right to reject inaccurate and substandard work. In the event such work is rejected, the contractor shall correct and replace rejected portions in a manner satisfactory and without cost to the government. The contractor shall coordinate his operations so as to permit direct contact with project manager purpose of inspection of work and general liaison.

11. PROJECT MANAGER.

The project manager for this survey mapping project will be Marjorie Courtright, Survey Section, 918-669-7574. All correspondence and information pertaining to the project will go through the project manager.

12. BILLING.

Payment requests shall be submitted to the A/E Contracts and Documents Section once each month. The request shall show a breakdown of all the related work tasks and percentage of work completed. Percent claimed will coincide with the progress report. The above should be mailed to:

*Tulsa District, Corps of Engineers
ATTN: Ginger Wilkins (CESWT-EC-Q)
1645 S. 101st E. Ave.
Tulsa, OK 74128-4629*

13. THE CONTRACTOR SHALL REFER TO APPLICABLE PORTIONS OF APPENDIX A FOR GENERAL AND TECHNICAL REQUIREMENTS NOT COVERED BY THIS SCOPE.

D-6. Jacksonville District Plane Table Topographic Survey Specifications (1989)

The following guidance is taken from a plane table specification developed by the Jacksonville District in the 1950s and 1960s, and last updated in 1989. Even though these criteria were developed around a plane table survey method, many of the general observation and detail requirements are still applicable to total station or RTK methods employed today. The accuracy specifications contained in this guidance are no longer applicable--see Chapter 4 for updated specifications. Other sections in this original document are not included--only Section 7 is excerpted below.

**TECHNICAL REQUIREMENTS FOR SURVEYING, MAPPING, AND PHOTOGRAMMETRIC
SERVICES
U S ARMY ENGINEER DISTRICT, JACKSONVILLE
ENGINEERING DIVISION -- SURVEY BRANCH
March 1989**

7. DETAILED SITE PLAN TOPOGRAPHIC MAPPING SURVEYS

7.1 General.

7.1.1 These surveys are required to, provide the information necessary for the planning, cost estimating, design, and relocation of structures in connection with construction responsibilities of the District. Surveys that fall within this category include, but are not limited to the following:

7.1.2 Civil projects, which include dam-sites, recreation areas, and the like, and may include strip topo for road or pipeline planning. Scales for civil projects may be 1"=20', 1"=50', 1"=100', or 1"=200', with possible variations in special cases.

7.1.3 Military projects, which cover Army and Air Force bases, ammunition plants, etc. Normal scale for detail planning is 1"=30' with 1' contours with variations in special cases.

7.1.4 These instructions are intended to be general since the individual assignment will vary as to contour interval, scale of the map, survey instrument (i.e. Plane Table, Radial, Total Station, Photogrammetric, etc) and detail necessary. Supplemental instructions will be issued for each job. The location of the site to be mapped and available control shall be furnished to the survey party.

7.2 Control.

7.2.1 The area to be mapped should be covered with a network of third order traverse. Good substantial semi-permanent points shall be set at each traverse station and located or described. At least two permanent markers shall be set and described on each site.

7.2.2 A level line of not less than third order should be run and elevations established as directed in the job instructions. Marks shall be established for use during construction as specified. Supplemental leveling by the use of alidade will not be permitted.

7.2.3 Field notes on both horizontal and vertical control will be submitted with other data for computing and final adjustment. Control points will be plotted on plane table sheets and symbolized as follows:

7.2.3.1 Monuments or disks in concrete by a triangle.

7.2.3.2 Hubs by a square.

7.2.3.3 Pipes, pins, or RR spikes by a circle.

7.2.3.4 Plastic hubs by a hexagon.

7.3 Plotting.

7.3.1 No rule can be laid down as to the number of elevations that should be determined from each plane table station for a given area. But rarely should shots be spaced greater than 1 inch on the plane table sheet. It will depend on the skill of the topographer and the configuration of the ground. Careless work is indicated when the contours vary from their true elevation by more than one-half the contour interval. Therefore, it stands to reason that a greater number of elevations are necessary for a 1- or 2- foot contour interval than are required for a larger contour interval. This is also true on a project that is to be mapped on a large scale.

7.3.2 Great emphasis should be placed on instruction and training of the rodman in a topographic party. He should be advised of job requirements in order to select points for "shots," as he is generally ranging far from the note keeper and is the only one in position to see details needed to complete map requirements.

7.3.3 A contour never splits, nor will they ever cross each other except in rare instances of an overhanging cliff, cave, or tunnel. When it is necessary to introduce an auxiliary contour, no more of it should be shown than is necessary to delineate the special feature which makes it necessary. A principle contour, on the other hand, should not have an end within the area to be mapped.

7.3.4 Index contours (multiples of 5 times interval shall be drawn heavier and labeled. Intermediate contours should be labeled when contours are not dense. On steep slopes the intermediate contours may be dropped, only the index being shown.

7.3.5 Special attention should be given to sheet edges. If necessary, a profile line of elevations should be run around the sheet edge to insure an unquestionable match to the adjoining sheet.

7.3.6 The purpose for which the survey is made will govern the amount of detail necessary. This will be covered in survey requirements for each job.

7.3.7 All culture will be shown by the use of symbols as adopted by these instructions. Should it become necessary for the topographer to use a symbol other than the standard topographic symbols, that symbol and the name of the feature it represents should be shown in a legend on the plane table sheet.

7.3.8 Topography notes are seldom used after a map is completed. However, questions sometimes arise when there is doubt as to the correctness of some points on the plane table sheets. When this occurs, it is necessary to refer to the field notes, and, for this reason, it is necessary to keep the topography notes.

7.3.9 The names of all roads, bridges, street, bodies of water, and other such features will be shown. Building will be identified by name and type. Any feature that cannot be shown by symbol will be identified by notation.

7.3.10 Adjoining sheets should accurately match and should be visually checked in the field to insure that the drainage, culture, surface, and subsurface structures truly represent actual conditions.

7.4 Features to be shown.

(NOTE: THESE FEATURES MUST BE DETAILED UNLESS SPECIFICALLY EXCLUDED WITHIN INDIVIDUAL PROJECT INSTRUCTIONS).

7.4.1 Natural drainage:

7.4.1.1 Elevations in drains as necessary to control contours and alignments.

7.4.1.2 On larger streams, top bank, water's edge, and depth.

7.4.2 Lakes, ponds, springs, wells:

7.4.2.1 Name, if any.

7.4.2.2 Depth.

7.4.3 Swamps, sinkholes:

7.4.4 Rock outcrops, rock areas:

7.4.5 Vegetation:

7.4.5.1 Size and description, such as. "Dense hardwood, heavy underbrush" (size) "Scattered pines" (Size) "Pecan orchard" (Size).

7.4.5.2 Prominent trees should be symbolized separately, particularly on military bases and in recreation areas.

7.4.5.3 Description of open land, whether pasture, cultivated, etc. If cultivated, what crop?

7.4.6 Section or property lines:

7.4.7 Buildings and structures:

7.4.7.1 Type of construction (as "Frame", "brick", etc.).

7.4.7.2 Building usage and name (residence, barn, school, etc.)

7.4.7.3 Building number, if on military base.

7.4.7.4 Position of building should be established by chaining to corners if critical to planned construction.

7.4.7.5 Floor elevations to nearest 0.01 foot.

7.4.7.6 Location of doors, steps, etc.

7.4.7.7 Entry points of utilities and location of meters, switch boxes, etc. if outside.

7.4.8 Roads, streets, walks, etc:

7.4.8.1 Type of surface and condition.

7.4.8.2 Elevations at centerline, edges of pavement, shoulders or gutter, top of curb. Critical elevations on paved surfaces should be determined to nearest 0.01 foot.

7.4.8.3 Type of gutter or curb and gutter (A cross-section sketch is usually helpful.)

7.4.8.4 Right-of-way width and limits (if not on government property).

7.4.8.5 Name of road or street.

7.4.8.6 Bridges (See also Paragraph 12.7).

7.4.8.6.1 Type of structure.

7.4.8.6.2 Elevations of floor and handrail.

7.4.8.6.3 Low steel, when required.

7.4.8.6.4 Wingwall description.

7.4.8.6.5 Separate sketch when critical to planning.

7.4.8.7 Culverts.

7.4.8.7.1 Size and type of pipe or box.

7.4.8.7.2 Elevation, top and inverts at each end.

7.4.8.7.3 Wingwall.

7.4.9 Railroads:

7.4.9.1 Alignment.

7.4.9.2 Number of tracks.

7.4.9.3 Elevations, base and top of rail (to nearest 0.01 foot).

7.4.9.4 Turnouts and sidings.

7.4.9.5 Drainage structures, size and invert elevations.

7.4.9.6 Weight of rail.

7.4.9.7 Width of right-of-way.

7.4.9.8 Operating company.

7.4.9.9 Size of ties (LxWxD) and center to center spacing.

7.4.9.10 Average depth of ballast below bottom of ties.

7.4.9.11 Typical cut and fill section.

7.4.9.12 Owner and description of utilities crossing railroad.

7.4.9.13 Curve data.

7.4.10 Water systems:

7.4.10.1 Pipe alignment, type, and size.

7.4.10.2 Invert of all pipes or tops of pipe elevation.

7.4.10.3 Location of fire hydrants and elevation.

7.4.10.4 Location of valves and elevation.

7.4.10.5 Storage tanks, elevation, and capacity.

7.4.11 Sanitary sewers.

7.4.11.1 Pipe alignment, type, and size.

7.4.11.2 Invert of all pipes or top of pipe elevations.

7.4.11.3 Manholes and all pipes, top and invert elevations.

7.4.11.4 Treatment plants in detail.

7.4.12 Storm sewers:

7.4.12.1 Alignment.

7.4.12.2 Pipe type and size.

7.4.12.3 Headwalls and end sections.

7.4.12.4 Manholes and all pipes, top and invert elevations.

7.4.12.5 Inlets, top and invert elevations, size of opening.

7.4.13 Fuel service:

7.4.13.1 Base lines, alignment and size.

7.4.13.2 Depth (elevation) of pipe.

7.4.13.3 Locations, sizes, and type of fuel in tanks.

7.4.14 Electrical power:

7.4.14.1 Sub-stations in detail.

7.4.14.2 Alignment of power lines.

7.4.14.3 Whether aerial or underground.

7.4.14.3.1 If underground, direct burial or duct.

7.4.14.3.2 Elevation.

7.4.14.4 Pole locations, approximate heights (elevation) and size, stamped nomenclature.

7.4.14.5 Size and type of conductors and voltage of system.

7.4.14.6 Location and size of transformers.

7.4.14.7 Location and type of manholes with elevations.

7.4.14.8 Operating company or agency.

7.4.14.9 Location of street lights.

7.4.14.10 Elevation of low wire at critical crossings (record atmospheric temperature time and date of observation.)

7.4.15 Telephone service:

7.4.15.1 Alignment.

7.4.15.2 Aerial or underground, direct burial or in duct, obtain top elevation.

7.4.15.3 Pole locations and heights, size, stamped nomenclature.

7.4.15.4 Manhole locations, type, elevation at top, and duct size.

7.4.15.5 Operating company or agency.

7.4.16 Heat distribution system:

7.4.16.1 Type of pipe if underground.

7.4.16.2 Alignment and elevations of distribution lines, size, pressure, or temperatures.

7.4.16.3 Locations and elevations of supports, anchors, manholes, traps, valves, expansion loops.

7.4.17 Fences:

7.4.17.1 Number of wires or type of fencing.

7.4.17.2 Height.

7.4.17.3 Kind of posts and spacing.

7.4.17.4 Location and size of gates.

7.4.17.5 Condition.

7.4.18 Runways, taxiways, aprons, etc:

7.4.18.1 Type of surface.

7.4.18.2 Dimensions.

7.4.18.3 Elevations to 0.01 foot at centerline and edges.

7.4.18.4 Positions of night lighting units and elevation at base.

7.4.18.5 Navigation aids and elevation of each.

7.4.18.6 Height of obstructions outside of area and ground elevation.

7.4.18.7 Service pits, etc.

7.4.19 North arrow:

7.4.19.1 Ten inches minimum length (on each sheet).

7.4.19.2 Type instrument.

7.4.19.3 Serial number.

7.5 Mapping Accuracy Requirements, Large Scale. Unless specified otherwise all mapping will meet the following horizontal and vertical accuracy requirements for scales of 10, 20, 30, 40, 50, 100, and 200 Feet to One Inch.

7.5.1 Contours: Ninety (90) percent of the elevations determined from the solid-line contours of the topographic maps shall have an accuracy with respect to true elevation of one-fourth (1/4) contour interval or better and the remaining ten (10) percent of such elevations shall not be in error by more than one-half (1/2) contour interval. In checking elevations taken from the map, the apparent vertical error may be decreased by assuming a horizontal displacement of one-fortieth (1/40) of an inch.

7.5.2 Coordinate Grid Lines: The plotted position of each plane coordinate grid shall not vary by more than one-hundredth (1/100) of an inch from true grid value on each map manuscript.

7.5.3 Horizontal Control: Each horizontal control point shall be plotted on the map manuscript within the coordinate grid in which it should lie to an accuracy of one-hundredth (1/100) of an inch of its true position as expressed by the coordinates computed for the point.

7.5.4 Planimetric Features: Ninety (90) Percent of all planimetric features which are well defined on the maps shall be plotted so that their position on the finished maps shall be accurate to within at least one-fortieth (1/40) of an inch of their true coordinate position, as determined by the test surveys, and none of the features tested shall be misplaced on the finished map by more than one-twentieth (1/20) of an inch from their true coordinate position.

7.5.5 Spot elevations: Ninety (90) percent of all spot elevations placed on the maps shall have an accuracy of at least one-tenth (1/10) the contour interval on natural ground and 0.01 foot for spot elevations on hard surfaces such as roads, sidewalks, sewers, pads, finished floors; etc.

7.6 Mapping Accuracy Requirements, Small Scale. Unless specified otherwise all mapping will meet the following horizontal and vertical accuracy requirements: scales of 400, 500, 800, and 1,000 Feet to One Inch.

7.6.1 Contours: Contours shall comply with the accuracy stipulations in 7.5.1.

7.6.2 Coordinate Grid Lines: The plotted position of each plane coordinate grid line shall not vary by more than one-eightieth (1/80) of an inch from true grid value on each map manuscript.

7.6.3 Horizontal Control: Each horizontal control point shall be plotted within the coordinate grid in which it should lie to an accuracy of one eightieth (1/80) of an inch of its true position as expressed by the coordinates computed for the point.

7.6.4 Planimetric Features: Ninety (90) percent of all planimetric map features shall be plotted so that their position on the finished maps shall be accurate to within at least one-thirtieth (1/30) of an inch of their true coordinate position, as determined by the test surveys, and none of the features tested shall be misplaced on the finished maps by more than one fifteenth (1/15) of an inch from their true coordinate position.

7.6.5 Spot Elevations: Spot elevations shall comply with stipulations in 7.5.5.

D-7. Typical State DOT Control and Topographic Survey Specification (Florida Department of Transportation)

GEODETIC CONTROL/HORIZONTAL ALIGNMENT

The CONSULTANT shall provide the DEPARTMENT with legible copies of all pertinent information utilized in making the field survey. All field survey data gathered will be furnished in a CAiCE readable format.

1. Establish geodetic baseline control on NAD 1983/1990 adjustment for the purpose of establishing horizontal control on the Florida State Plane Coordinate System. After the project network control has been processed and adjusted, the CONSULTANT will archive and forward to the District Surveying and Mapping Consultant Manager for review and approval. All data will be recorded in the CAiCE database.

NOTE: See Standards for FDOT GLOBAL POSITIONING SYSTEM SURVEY for HORIZONTAL NETWORKS (Amended December 21, 2000). You can obtain a copy from the Survey and Mapping Consultant Management department.

Primary Horizontal Control/GPS points shall be poured in place concrete monuments with brass disk set two inches below natural ground level at two to three mile intervals throughout the project. Secondary Horizontal Control points shall be iron rods and caps set at no more than two thousand foot intervals and will be inter-visible. Consultant may densify horizontal control as needed.

2. Using a total station and an electronic data collector with FDOT Electronic Field Book software, make all necessary Centerline, Subdivision, Lot, Block, and Right of Way ties necessary to reestablish the centerline of all of the dedicated right-of-way along the project as per furnished Right of Way maps.

3. Calculate the Centerline Alignment and Existing Right of Way lines for the main corridor and any dedicated connecting side roads. An alignment geometry chain, named "CL1", is to be created for the centerline of the main corridor, and each dedicated (by right of way maps) connecting side road will have a separate geometry chain named "SCL". In addition, a separate geometry chain is to be created for every Right of Way line calculated. The alignment is to be approved in writing by the District Location Surveyor before any staking of the alignment begins. The preferred procedure for obtaining alignment approval is to generate a hard copy of proposed alignment showing comparisons with field versus existing Right of Way Map distances and curve information, along with stations and offsets to found monumentation. Schedule a time with the Survey Consultant Project Manager and District Location Surveyor to go over and discuss proposed alignment.*

4. Stake and station the centerline alignment established for the main corridor and any dedicated (by right of way map) connecting side roads at even thousand (1000) foot stations including the beginning and ending of project stations and all P.C.'s, P.T.'s, and Non-Curve P.I.'s and at the intersection of state roads and any dedicated (by right of way maps) connecting side roads. All centerline points will be referenced (including the begin and end of survey), making sure that all references are outside of the right-of-way for the main corridor and all dedicated connecting side streets. All data will be recorded in the CAiCE database. Centerline alignments along dedicated side streets shall begin at the centerline of the main corridor and extend five hundred (500) feet beyond the existing or proposed right of way line of main corridor.

NOTE: On projects where there will be no right of way taking, the first reference should be set at the existing right of way line at 90 degrees to the baseline. These points should be copper coated iron rods and cap with a delineator post.

NOTE: All centerline reference points will be chained together and placed in zone 11 of the CAiCE database resulting in each centerline control point having one chain (called CLREF) describing its own references.*

NOTE: The consultant will be responsible for providing any incidental survey supplies, (i.e. control point disks, copper coated rods, Carsonite posts, etc.)

GPS STANDARDS--FDOT GLOBAL POSITIONING SYSTEM SURVEY STANDARDS FOR HORIZONTAL NETWORKS Amended December 21, 2000

I. EXISTING CONTROL

Every Global Positioning System (GPS) control survey will constrain to approved agency horizontal control points.

II. NETWORK DESIGN PLAN

Every GPS control project will have a Network Design Plan (NDP) submitted and approved by the District Location Surveyor (DLS) or his authorized representative. The NDP will consist of the following:

- A. The Layout of the Network Geometry.*
- B. Mission Plan*
- C. Identification of equipment to be used.*

NOTE: Equipment for all GPS work will be survey grade, carrier phase, geodetic receivers.

III. PRIMARY CONTROL STATION NAMING

Primary control station naming must adhere to the standard Department naming convention as described in the Location Survey Manual. The station names will be provided to the consultant by the District Location Surveyor or his representative.

IV. ADJUSTMENT

NOTE: All vectors referred to in this section are independent vectors.

- A. The final adjustment will be done with the latest Department approved network adjustment software.*
- B. The error estimates for constant error will be 0.005 meters and 5 PPM for proportional error.*
- C. All control will be held fixed, unless otherwise approved.*
- D. The final constrained adjustment will meet the following positional tolerances:*

NOTE: The value of the positional tolerance for a GPS station is its 95% confidence error ellipse semi-major axis derived from the constrained adjustment. To obtain this value the error ellipse semi-major axis derived from the least squares variance-covariance matrix is multiplied by the standard error of unit weight (a "scale" of data quality) and the F statistic multiplier (raises confidence from one sigma to 95% based on number of degrees of freedom). The test on the positional tolerance value is based on a constant and proportional error tolerance (usually 0.01 m. and 1/100,000 for primary FDOT networks). The proportional error is multiplied by the straight line distance to the nearest control point in the constrained adjustment. Therefore, using the stated tolerance values, an unknown point 1,000 meters from the nearest control point would have an allowable positional

*tolerance of 0.01 m. + (1/100,000) * 1000 m. = 0.02m. If this point's actual positional tolerance exceeds that value it has failed the positional tolerance test.*

	Constant error	Proportional error	Minimum # of horiz. control pts.	Minimum # of occupations for ea. point
Primary Control	0.010 (m)	1/100,000	3	2
Secondary Control	0.030 (m)	1/50,000	2	2
Other	0.050 (m)	1/30,000	2	2

V. GPS DELIVERABLES

NOTE: The GPS primary control survey must be submitted to and approved by the District Location Surveyor (DLS) or authorized representative in writing prior to finalizing secondary and other control surveys.

A. Primary Control Survey

Final Network Design Plan in electronic or hard copy format.

ASCII activity log in electronic or hard copy format.

ASCII file containing raw vectors from proprietary software in electronic format.

All adjusted data and computations from "Vector" software in electronic format. This includes all input files and output files for the minimally constrained adjustment and for the final constrained adjustment.

Items identified by the District Location Surveyor.

B. Secondary Control Survey

ASCII file containing raw vectors from proprietary software in electronic format.

All adjusted data and computations from "Vector" software in electronic format. This includes all input files and output files for the minimally constrained adjustment and for the final constrained adjustment.

Items identified by the District Location Surveyor.

C. Other Control Surveys

Items identified by the District Location Surveyor

Vertical Bench Line

The CONSULTANT shall provide the DEPARTMENT with legible copies of all pertinent information utilized in making the field survey. All field survey data gathered by use of electronic field book will be furnished in a CAiCE readable format.

Establish permanent Bench Marks poured-in-place concrete monuments and brass disc at one-mile intervals. Provide the Consultant Project Management Department with to reach forms for all permanent Bench Marks set. A series of secondary Bench Marks shall be set throughout the project at approximately one thousand (1,000) foot intervals and outside the anticipated limits of construction. Using a level and an electronic data collector with FDOT Electronic Field Book software, employ the three (3) wire method of running from an established bench mark (NAVD 88 unless approved otherwise) through the job bench marks to another established bench mark to obtain the adjusted elevation for the job bench marks. Provide to the Consultant Project Management Department a hard copy of the Bench Mark table to include name, elevation, (the elevation datum used must be clearly identified), station &

offset and description for each Bench Mark. All data (including vertical datum and a copy of the bench mark table) will be recorded in the CAiCE database and called "BM.Rpt".

NOTE: The consultant will be responsible for providing any incidental survey supplies, (i.e. control point disks, copper coated rods, Carsonite posts, etc.)

Topographic/DTM Survey

The CONSULTANT shall provide the DEPARTMENT with legible copies of all pertinent information utilized in making the field survey. All field survey data shall be gathered by use of electronic field book and will be furnished in a CAiCE readable format.

1. Using a total station and an electronic data collector with the FDOT Electronic Field Book Software, locate all topography (buildings, mail boxes, driveways, sidewalks, fences, signs, street light poles, utilities, pavement, pavement markings, pavement joints, traffic signals, curbing, curb cuts, ADA ramps, structures, ornamental trees, shrubs, tree lines, etc.) to ten (10) feet outside the existing right of way lines or thirty (30) feet outside the proposed right-of-way lines, if applicable. When right of way is being acquired, locate all improvements on commercial use properties, even if such improvements are outside thirty (30) feet from the proposed taking.
2. Using a total station and electronic data collector with the FDOT Electronic Field Book software, collect sufficient data to generate a Digital Terrain Model (DTM) to ten (10) feet outside the existing right of way lines or thirty (30) feet outside the proposed right of way lines, if applicable.
3. Take independent cross-sections at a maximum of one thousand (1,000) foot intervals to verify the Digital Terrain Model (DTM). These check sections should be recorded manually in a field book furnished by the DEPARTMENT. Under no circumstances are these check sections to be incorporated into the DTM.
4. Locate all above ground evidence of utilities (signs, pedestals, manholes, valve covers, etc.) and add to the CAiCE database.
5. Locate and obtain invert elevations on all pipes (side drains, cross drains, force mains, storm/sanitary, etc.) within the limits of the project. NOTE: In all cases when a manhole falls outside these limits but is needed to determine grade and location of a pipe within these limits, the manhole should be located and inverts obtained.
6. Make complete side street and road surveys to include topography and DTM for one hundred (100) feet beyond the mainline existing or proposed right of way line and to 10 feet beyond the side streets existing right-of-way lines. For side streets dedicated by right of way maps, this survey shall extend three (300) feet beyond the mainline existing or proposed right of way line.

Underground Utility Survey

The CONSULTANT will provide all services required for obtaining subsurface utility facilities including designating, locating and surveying.

Definitions: The term "designate" in this Scope of Services shall mean to indicate, by marking, the presence and approximate horizontal depth of all existing subsurface utilities using standard geophysical prospecting techniques. The CONSULTANT does not guarantee the accuracy of such designations as substitutions for as-built information obtained during any demolition, excavation, or construction activities. The term "locate" shall mean to obtain an accurate position (horizontal and vertical) of subsurface utilities by excavating a test hole and recording the position by survey methods.

Control and Alignment Survey:

Provide all the survey services to recover and/or reestablish the existing centerline and/or baseline for State Road XXX and any connecting side roads. Also recover and/or reestablish the existing horizontal and vertical control, as needed, throughout the limits of the project. Note: The CONSULTANT may densify the horizontal and vertical control if necessary. All data shall be recorded in the CAiCE database.

Subsurface Utility Designation: The subsurface utility designation services will include, but not be limited to, the following:

Obtain all necessary permits from city, county, municipality or other jurisdiction to allow the CONSULTANT to work in existing streets, roads, and other locations necessary for marking, measuring and recording the location of the existing utilities. Coordinate with utility agencies/owners.

Secure all utility as-built plans, plats, and other data as necessary to help designate the utilities. All plans, plats or other data in hard copy or electronic files containing utility information will be delivered to the DEPARTMENT.

Provide all traffic control within the work area while locating the subsurface utilities. Traffic control shall be maintained in accordance with DEPARTMENT policy and MUTCD and/or Roadway and Traffic Design Standards (Index 600). Provide all safety devices, signs and other safety equipment, including flagging personnel.

Designate and mark the horizontal location of each existing underground utility and their major laterals to existing buildings using a method pre-approved by the Department's Project Manager. The designation of the subsurface utility must be as close as possible to the true location of the existing utility.

Using a total station and an electronic data collector with the FDOT Electronic Field Book (EFB) Software, locate the designated utilities and add this information to the existing CAiCE database in the following manner:

All shots taken to measure the location of the designated utility are to be recorded in "ZONE 6" of the CAiCE database with a "U" attribute. The shots taken are to be on the surface of the ground or pavement above the utility and the surface shot should be good for elevation. A statement is to be placed in the description of each shot stating where the shot was taken (i.e., ground shot over gas line, pavement shot over a waterline, etc.). A chain is to be created and stored in "ZONE 6" of the CAiCE database with a "U" attribute, for each utility located. This chain is to be stored in the same direction as the baseline and/or centerline of survey that is in the existing CAiCE database. A statement is to be placed in the comments of each chain stating the owner of the utility. In addition, the description field of the chain shall state the type of the utility (i.e., gas, fiber optic, TV cable, etc.).

A station-offset report called "DESNATE.REP" is to be created and stored in the CAiCE database showing the station and offset to each utility chain designated.

Subsurface Utility Location (VVH): The subsurface utility location service will include, but not be limited to, the following:

Obtain all necessary permits from city, county, municipality or other jurisdiction to allow the CONSULTANT to work in existing streets, roads, and other locations necessary for the purpose of excavating, measuring and recording the location and depth of the existing utilities. Coordinate with utility agencies/owners.

Secure all utility as-built plans, plats, and other data necessary to help in locating and identifying the utilities. All plans, plats or other data in hard copy or electronic files containing utility information will be delivered to the DEPARTMENT.

Provide all traffic control within the work area while locating the subsurface utilities. Traffic control shall be maintained in accordance with DEPARTMENT policy and MUTCD and/or Roadway and

Traffic Design Standards (Index 600). Provide all safety devices, signs and other safety equipment, including flagging personnel.

Neatly cut and remove existing pavement or other material (not to exceed two hundred twenty-five (225) square inches per cut). Excavate the material in such a manner as to prevent any damage to wrappings, coatings or other protective coverings of the utility (i.e., vacuum/pressure excavations, hand digging, etc.).

Backfill and compact with select material around the utility. Provide a restoration of the surface pavement, within the limits of the cut, at the time of the backfill. In the event the excavation is in an area other than roadway pavements, the disturbed area will be restored to the condition before the excavation.

Furnish and install color-coded permanent above ground markers (i.e., PK nails, steel rods, etc.), on the surface directly above the centerline of the utility being located.

Provide complete clean up of work sites to equal or better conditions that existed before excavation began and close out all existing permits as required.

For each test hole location, complete and provide to the DEPARTMENT a "Subsurface Utility Form". The format of the form is to be pre-approved by the DEPARTMENT before Submittal.

Using a total station and an electronic data collector with the FDOT Electronic Field Book (EFB) Software, locate the utility both horizontally and vertically where test hole locations have been performed and add the information to the existing CAiCE database in the following manner:

All shots taken to measure the location of the utility at a test hole location are to be called VVH and have a Feature Code of a "CSH" meaning Core Sample Hole. These VVH* points are to be recorded in ZONE 6 of the CAiCE database with a "U" attribute. The elevation on the shot should be taken on top of the utility. In the description field of each shot describe the size, utility type, material type (i.e., 6" PVC water line, fiber optic in 2" metal conduit, 100 pair Southern Bell direct buried, etc.), below surface depth of the utility and place the initials VVH, meaning verified vertical and horizontal.*

A station-offset report called "LOCATE.REP" is to be generated and stored in the CAiCE database for each utility test hole location.

D-8. Guide Specification for Developing a Topographic Surveying Indefinite Delivery Contract

INSTRUCTIONS

1. General. This guide specification is intended for use in preparing Architect-Engineer (A-E) Indefinite Delivery Contracts (IDC) for professional surveying and mapping services. These specifications are applicable to all surveying and mapping contracts used to support USACE civil works and military design and construction, operations, maintenance, regulatory, and real estate activities. This guide is primarily for use in establishing procedures and specifications obtained through contracts under Public Law (PL) 92-582 (Brooks A-E Act) qualification-based selection procedures and for which unit prices in the contract schedule are negotiated.

2. Coverage. This guide specification contains technical standards and/or references necessary to specify the more common phases of a topographic and planimetric feature detail mapping project performed by conventional methods.

3. Applicability. The following types of A-E contract actions are supported by these instructions:

- Fixed-price service contracts.
- Indefinite delivery contracts.
- A multi-discipline surveying and mapping IDC contract in which topographic mapping services are a line item supporting other surveying, mapping, hydrographic, and photogrammetric services.
- A work order or delivery order placed against an IDC contract.
- Design and design-construct contracts that include incidental surveying and mapping services (including Title II services). Both fixed-price and IDC design contracts are supported by these instructions.

4. General Guide Use. This guide is primarily intended for field-to-finish topographic and planimetric feature detail survey contracts for large-scale site plan mapping to support engineering design for civil works and military construction projects. The final mapping product with supporting data should be completely suitable for use as a medium to support design and development of contract construction plans and specifications. Specifying field-to-finish implies that all phases of the mapping process, from establishing control, field acquisition, compilation, and delivery of the final compiled product will be performed by the contractor in which the contractor is responsible for complete quality control over all phases of the work. In adapting this guide to any project, specific requirements will be modified as necessary for the work contemplated. Changes will be made by deletions or insertions within this format.

5. Insertion of Technical Specifications. This manual (EM 1110-1-1005) should be attached to and made part of any service contract for mapping services. This manual contains specifications and quality control criteria for field-to-finish execution of a mapping project. Technical specifications for other survey functions required in a surveying and mapping services contract should be developed from other guide specifications applicable to the discipline(s) required. Standards and other specifications should be checked for obsolescence and for dates of applicability of amendments and revisions issued subsequent to the publication of this specification. Maximum use should be made of existing EMs, Technical Manuals, and other recognized industry standards and specifications.

7. Alternate Clauses/Provisions or Options. In order to distinguish between required clauses and optional clauses, required clauses are generally shown in capital letters. Optional or selective clauses, such as would be used in a work order, are generally in lower case.

8. Notes and Comments. General comments and instructions used in this guide are contained in asterisk blocks. These comments and instructions should be removed from the final contract.

9. IDC Contracts and Individual Work Order Assignments. Contract clauses which pertain to IDC contracts, or task orders thereto, are generally indicated by notes adjacent to the provision. These clauses should be deleted for fixed-price contracts. In general, sections dealing with IDC contracts are supplemented with appropriate comments pertaining to their use. Work orders against a basic IDC contract may be constructed using the format contained in Section C of this guide. Clauses in the basic contract should not need to be repeated in work orders. Contract section C is applicable to any type of surveying and mapping service contracting action.

**THE CONTRACT SCHEDULE
SECTION A
SOLICITATION/CONTRACT FORM**

NOTE: Include here SF 252 in accordance with the instructions in EFARS.

SF 252 -- (Block 5): PROJECT TITLE AND LOCATION

NOTE: Sample title for fixed-price contract

TOPOGRAPHIC AND PLANIMETRIC DETAIL SURVEYS IN SUPPORT OF SITE PLAN DEVELOPMENT FOR
PRELIMINARY CONCEPT DESIGN OF ENGINEERING INSTALLATION FACILITY, _____ AFB, TEXAS.
TOPOGRAPHIC MAPPING SERVICES CHANNEL IMPROVEMENT, LOCAL FLOOD PROTECTION PROJECT
_____ WASHINGTON.

NOTE: Sample title for indefinite delivery type contract.

INDEFINITE DELIVERY CONTRACT FOR PROFESSIONAL SURVEYING AND MAPPING AND RELATED
SERVICES IN SUPPORT OF VARIOUS *[CIVIL WORKS] [MILITARY CONSTRUCTION] PROJECTS
*[IN] [ASSIGNED TO] THE _____ DISTRICT.

**SECTION B
SERVICES AND PRICES/COSTS**

NOTE: The fee schedule for topographic mapping and related survey services should be developed in conjunction
with the preparation of the independent government estimate (IGE) along with the technical specifications.

**SECTION C
STATEMENT OF WORK**

C.1 GENERAL. THE CONTRACTOR, OPERATING AS AN INDEPENDENT CONTRACTOR AND NOT AS AN
AGENT OF THE GOVERNMENT, SHALL PROVIDE ALL LABOR, MATERIAL, AND EQUIPMENT NECESSARY TO
PERFORM THE PROFESSIONAL SURVEYING AND MAPPING AND *[RELATED SERVICES] *[FROM TIME TO
TIME] DURING THE PERIOD OF SERVICE AS STATED IN SECTION D, IN CONNECTION WITH PERFORMANCE
OF TOPOGRAPHIC SURVEYS AND THE PREPARATION OF SUCH MAPS AS MAY BE REQUIRED FOR
*[ADVANCE PLANNING] [DESIGN] [AND CONSTRUCTION] [or other function] ON [VARIOUS PROJECTS] [specify
project(s)]. THE CONTRACTOR SHALL FURNISH THE REQUIRED PERSONNEL, EQUIPMENT,
INSTRUMENTATION, AND TRANSPORTATION AS NECESSARY TO ACCOMPLISH ALL REQUIRED SERVICES
AND FURNISH TO THE GOVERNMENT DETAILED MAPS, PLATS, DIGITAL TERRAIN DATA, UTILITY DETAIL
SHEETS, CONTROL DATA FORMS, REPORTS, AND OTHER DATA WITH SUPPORTING MATERIAL
DEVELOPED DURING THE FIELD DATA ACQUISITION AND COMPILATION PROCESS. DURING THE
PROSECUTION OF THE WORK, THE CONTRACTOR SHALL PROVIDE ADEQUATE PROFESSIONAL
SUPERVISION AND QUALITY CONTROL TO ASSURE THE ACCURACY, QUALITY, COMPLETENESS, AND
PROGRESS OF THE WORK.

NOTE: The above clause is intended for use in an IDC contract for topographic and planimetric mapping services. It
may be used for fixed-price service contracts by deleting appropriate IDC language and adding the specific project
survey required. This clause is not repeated on individual delivery orders.

C.2 LOCATION OF WORK.

NOTE: Use the following clause for a fixed-scope contract of individual work order.

C.2.1. TOPOGRAPHIC MAPPING AND RELATED SURVEYING SERVICES WILL BE PERFORMED AT [_____] *[list project area, installation, etc.]. *[A MAP EXHIBIT DEFINING THE SITE LOCATION AND PROJECT AREA IS ATTACHED AT SECTION G OF THIS CONTRACT.]

NOTE: Use the following when specifying an indefinite delivery contract for topographic mapping services.

C.2.2 TOPOGRAPHIC MAPPING AND RELATED SURVEYING SERVICES WILL BE PERFORMED IN CONNECTION WITH PROJECTS *[LOCATED IN] [ASSIGNED TO] THE [_____] DISTRICT. *[THE _____] DISTRICT INCLUDES THE GEOGRAPHICAL REGIONS WITHIN *[AND COASTAL WATERS] [AND RIVER SYSTEMS] ADJACENT TO:]

*[list states, regions, etc.]

NOTE: Note also any local points-of-contact, right-of-entry requirements, clearing restrictions, installation security requirements, etc.

C.3 TECHNICAL CRITERIA AND STANDARDS. THE FOLLOWING STANDARDS ARE REFERENCED IN THIS GUIDE. STATE OR LOCAL CODES MAY HAVE PRIORITY.

C.3.1 USACE EM 1110-1-1005. THIS REFERENCE IS ATTACHED TO AND MADE PART OF THIS CONTRACT. (SEE SECTION G.)

C.3.2 USACE EM 1110-1-1002, SURVEY MARKERS AND MONUMENTATION. *[THIS REFERENCE IS ATTACHED TO AND MADE PART OF THIS CONTRACT (SEE SECTION G)]

C.3.3. A/E/C CADD STANDARDS

C.3.3. *[District Drafting Standards, sheet sizes, types, formats, etc.].

C.3.4. *[Other applicable references, appendices].

Note: List other reference standards that may be applicable to some phase of the work such as other Engineer Manuals or standard criteria documents. Such documents need not be attached to the Contract; if attached, however, reference should be made to their placement in contract Section G.

C.4 WORK TO BE PERFORMED. PROFESSIONAL SURVEYING AND MAPPING AND RELATED SERVICES TO BE PERFORMED UNDER THIS CONTRACT ARE DEFINED BELOW. UNLESS OTHERWISE INDICATED IN THIS CONTRACT *[OR IN DELIVERY ORDERS THERETO], EACH REQUIRED SERVICE SHALL INCLUDE FIELD-TO-FINISH EFFORT. ALL MAPPING WORK WILL BE PERFORMED USING APPROPRIATE INSTRUMENTATION AND PROCEDURES FOR ESTABLISHING CONTROL, FIELD DATA ACQUISITION, AND COMPILATION IN ACCORDANCE WITH THE FUNCTIONAL ACCURACY REQUIREMENTS TO INCLUDE ALL QUALITY CONTROL ASSOCIATED WITH THESE FUNCTIONS. THE WORK WILL BE ACCOMPLISHED IN STRICT ACCORDANCE WITH SURVEYING AND MAPPING CRITERIA CONTAINED IN THE TECHNICAL REFERENCES (PARAGRAPH C.3 ABOVE), EXCEPT AS MODIFIED OR AMPLIFIED HEREIN.

NOTE: The following clauses in this section of the guide may be used for either fixed-price surveying and mapping contracts, IDC work orders under an IDC contract, or IDC contracts where surveying and mapping services are part of a schedule of various survey disciplines.

C.4.1. PURPOSE OF WORK. THE WORK TO BE PERFORMED UNDER THIS CONTRACT IS TO BE USED AS BASIC SITE PLAN MAPPING INFORMATION TO SUPPORT *[BE INCORPORATED INTO] [INSTALLATION/BASE COMPREHENSIVE MASTER PLANNING] [ENGINEERING DESIGN] [CONSTRUCTION] [OPERATION] [MAINTENANCE] [REAL ESTATE] [REGULATORY] [HAZARDOUS AND TOXIC WASTE SITE]; INCLUDING ALL RELATED ACTIVITIES.

NOTE: A description of the functional purpose of the mapping product should be stated in order for the contractor to focus his efforts and quality control toward the more critical aspects of the project. The above clause should fully define the intended use of the mapping product to be furnished by the contractor.

C.4.2. GENERAL SURVEYING AND MAPPING REQUIREMENTS. TOPOGRAPHIC AND PLANIMETRIC FEATURE DETAIL MAPS SHALL BE COMPILED AT A TARGET SCALE OF 1 IN. = [] FT FOR THE SITE DELINEATED ON EXHIBIT ATTACHED AT SECTION G. THE MAPPING AND/OR RELATED DIGITAL PRODUCTS SHALL MEET OR EXCEED USACE (ASPRS) CLASS *[] ACCURACY STANDARDS AS SPECIFIED IN EM 1110-1-1005. PLANIMETRIC FEATURE DETAIL WILL BE COMPILED IN ACCORDANCE WITH THE HORIZONTAL ACCURACY STANDARDS SET FOR THIS CLASS. CONTOURS SHALL BE DEVELOPED AT [] - FT INTERVALS IN ACCORDANCE WITH THE VERTICAL ACCURACY STANDARDS SET FOR THIS CLASS. FEATURE AND TERRAIN DATA SHALL BE DELIVERED IN *[HARD COPY AND] DIGITAL FORMAT.

NOTE: The above clause should be used for fixed-scope contracts of IDC contract work orders to give an overview of the general mapping effort. Technical requirements will be described in subsequent paragraphs. Note that the final map compilation target scale and ASPRS Accuracy Class/Standard is defined upfront in the scope of work. IDC contracts and work orders: Since specific project scopes are indefinite at the time a basic contract is prepared, only general technical criteria and standards can be outlined. Project of site-specific criteria will be contained in each delivery order along with any deviations from the technical standards identified in the basic IDC contract. The clauses contained within the remainder of the contract are used to develop general requirements for a basic IDC contract. Subsequent delivery orders will reference these clauses, adding project-specific work requirements as required. Delivery order formats should follow the outline established for the basic IDC contract.

C.4.3. FIELD PROCEDURES AND REQUIREMENTS. APPROPRIATE INSTRUMENTATION AND PROCEDURES, CONSISTENT WITH ACCEPTED PROFESSIONAL SURVEYING AND MAPPING INDUSTRY STANDARDS AND PRACTICE, SHALL BE SELECTED TO ACHIEVE THE ACCURACY STANDARDS REQUIRED. THE CONTRACTOR SHALL FIELD A FULLY EQUIPPED SURVEY CREW(S), CONSISTING OF PROFESSIONAL SURVEY PERSONNEL, EXPERIENCED IN PERFORMING THE REQUIRED SURVEYS AND CAPABLE OF COMPLETING THE WORK WITHIN ALLOTTED SCHEDULES. ALL FIELD OBSERVATIONAL DATA REQUIRED TO SET AND ESTABLISH PROJECT CONTROL SHALL BE RECORDED IN STANDARD PERMANENT BOUND FIELD BOOKS WHICH WILL SUBSEQUENTLY BE DELIVERED TO THE GOVERNMENT. ALL SURVEY WORK SHALL BE PERFORMED UNDER ADEQUATE SUPERVISION AND QUALITY CONTROL MEASURES. *[ALL SURVEY WORK, INCLUDING OFFICE COMPUTATIONS AND ADJUSTMENTS, IS SUBJECT TO GOVERNMENT REVIEW AND APPROVAL FOR CONFORMANCE WITH PRESCRIBED ACCURACY STANDARDS. DEFICIENCIES WILL BE RECOGNIZED AND STEPS TO INITIATE CORRECTIVE ACTIONS SHALL BE TAKEN AS REQUIRED]. *[THE CONTRACTOR SHALL ALLOW DIRECT CONTACT WITH RESPONSIBLE-IN-CHARGE PERSONNEL FOR EACH PHASE OF THE WORK FOR PURPOSES OF PROGRESS ESTIMATES AND COMPLIANCE WITH THE CONTRACT REQUIREMENTS].

C.4.3.1. HORIZONTAL CONTROL SHALL REFERENCE EXISTING PROJECT AREA CONTROL. CONTROLLING POINTS SHALL BE OCCUPIED AS A STATION WITHIN A CLOSED TRAVERSE THAT WILL MEET OR EXCEED *[THIRD][]- ORDER, *[CLASS*[I][] RELATIVE ACCURACY CLASSIFICATION *[OR 1 PART IN 10,000] [] AS ESTABLISHED FOR ASPRS CLASS *[] MAPPING STANDARDS. THE TRAVERSE SHALL INITIATE AND CLOSE UPON ACCEPTABLE CONTROL MONUMENTATION USED TO ESTABLISH THE EXISTING PROJECT GRID SYSTEM. ALL GRID COORDINATES SHOWN ON THE MAP PRODUCTS SHALL BE EXPRESSED IN OR CONVERTED TO, *[US SURVEY FEET] [INTERNATIONAL FEET] [METERS]. COORDINATES SHALL BE REFERENCED TO THE LOCAL *[SPCS 27] [SPCS 83] [UTM ZONE].

C.4.3.2. VERTICAL CONTROL SHALL BE REFERENCED TO *[NGVD 29][NAVD 88]. CONTROLLING POINTS SHALL BE ESTABLISHED WITHIN A CLOSED LEVEL LOOP THAT WILL MEET OR EXCEED *[THIRD] []-ORDER,

ACCURACY STANDARDS AS ESTABLISHED FOR ASPRS CLASS *[] MAPPING STANDARDS. ELEVATIONS SHALL ORIGINATE AND CLOSE ON ACCEPTABLE BENCHMARKS IN THE PROJECT AREA.

NOTE: Few USACE surveying and mapping projects require relative accuracy classifications in excess of Third Order, Class I, 1:10,000 for horizontal control and Third Order 1:5,000 for vertical control. Although instrumentation, conventional and GPS, are capable of achieving higher accuracy requirements, specifying higher levels of accuracy may adversely impact the overall project cost and should be thoroughly justified relative to the required mapping accuracies and other factors.

C.4.3.3. EXISTING PROJECT/NETWORK CONTROL. A TABULATION AND/OR DESCRIPTION OF EXISTING PROJECT/NETWORK CONTROL POINTS *[IS SHOWN BELOW] [IS SHOWN IN ATTACHMENT] [WILL BE PROVIDED IN THE DELIVERY ORDER]. THE SOURCE AGENCY, COORDINATES, DATUM, AND ESTIMATED ACCURACY OF EACH POINT ARE INDICATED. PRIOR TO USING ANY CONTROL POINTS, THE MONUMENTS SHOULD BE CHECKED TO ENSURE THAT THEY HAVE NOT BEEN MOVED OR DISTURBED.

NOTE: List existing control station(s) or, alternately, refer to a map exhibit, tabulation attachment, and/or descriptions that would be included in an attachment.

a. *The contractor shall perform the necessary surveys to connect existing project control to assure that such control has sufficient relative accuracy to adequately control the overall project. Should these surveys indicate deficiencies in the existing control, the contractor shall advise the Contracting Officer *[or Contracting Officer Representative]. The contractor shall furnish the appropriate data indicating a deficiency. If the Contracting Officer *[or Contracting Officer Representative] deems it necessary to perform resurveys of the existing network, appropriate modification may be made to the contract.

b. *Suitable control monumentation shall be set as required to adequately control construction phases. All stations shall be monumented in accordance with EM 1110-1-1002, Survey Markers and Monumentation. Monumentation for this project shall be Type *[] for horizontal and Type *[] for vertical, per EM 1110-1-1002 criteria. *[Monumentation shall be defined to include the required reference marks and azimuth marks required by EM 1110-1-1002.]

NOTE: Deviations from EM 1110-1-1002 should be indicated as required. USACE project control rarely requires supplemental reference/azimuth marks - the optional specification clauses below should be tailored accordingly.

c. *At each station, angle and distance measurements shall be made between a network station and reference/azimuth marks established in accordance with the requirements set forth in EM 1110-1-1002. All observations shall be recorded in a standard bound field book or comparable electronic notebook.

(1) *For reference marks, two (2) directional positions are required (reject limit + 10-second arc) and with steel taping performed to the nearest + 0.01 ft.

(2) *Four directional positions are required for azimuth marks. The reject limit for a 1-second theodolite is + 5 seconds. Azimuth mark landmarks shall be easily defined/described natural features or structures of sufficient distance to maintain a *[]-second angular accuracy. *[]-order astronomic azimuths shall be observed to azimuth marks.]

(3) *A compass reading shall be taken at each station to reference monuments and azimuth marks.

C.4.3.4. STATION DESCRIPTION AND RECOVERY REQUIREMENTS.

a. *Station descriptions and/or recovery notes shall be written in accordance with the instructions contained in EM 1110-1-1002. *[Form [] shall be used for these descriptions.] Descriptions shall be *[written] [typed].

b. *Descriptions *[are] [are not] required for *[existing] [and/or newly established] stations.

c. *Recovery notes *[are] [are not] required for existing stations.

d. *A project control sketch *[is] [is not] required.

C.4.4. FIELD CLASSIFICATION AND MAP CHECK SURVEYS. FIELD CLASSIFICATION, INSPECTION, AND/OR CHECK/MAP ACCURACY TEST SURVEYS *[WILL] [WILL NOT] BE PERFORMED *[ON THIS PROJECT].

NOTE: Tests for compliance of a map sheet are optional. Check points are based on "well-defined points" established in a manner agreed upon by the contracting parties. Criteria for testing for map accuracy compliance are defined in the ASPRS Accuracy Standards for Large-Scale Maps.

C.5. MAP COMPILATION, DRAFTING, AND CADD SPECIFICATIONS.

C.5.1. MAP COMPILATION SCALE. THE CONTRACTOR SHALL FURNISH *[REPRODUCIBLE] FINISHED MAPS AT A SCALE OF 1 IN. = *[] FT. THE MAP MEDIA SHALL BE COMPUTER-GENERATED PLOTS ON *[PAPER] [HIGH-GRADE, STABLE BASE MYLAR NOT LESS THAN *[] IN. IN THICKNESS] *[E] [] - SIZE SHEETS].

C.5.2 TOPOGRAPHIC AND PLANIMETRIC FEATURES. THE MAPS SHALL CONTAIN ALL TOPOGRAPHIC AND PLANIMETRIC FEATURES ENCOUNTERED WITHIN THE PROJECT LIMITS. THE MAPS SHALL PROPERLY DEPICT THE EXISTING SITE CONDITIONS AS NECESSARY FOR THE PROPER USE OF THEIR INTENDED PURPOSE. THE FINAL MAPPING PRODUCT GENERATED BY THE CONTRACTOR SHALL COMPLY WITH AND CONTAIN BUT NOT BE LIMITED TO THE FOLLOWING:

a. TERRAIN FEATURES/CONTOUR DEVELOPMENT. *[THE CONTOUR INTERVAL FOR THIS PROJECT IS FT.]. CONTOURS SHALL BE LEGIBLE AND DRAWN SHARP AND CLEAR AS SOLID LINES. EVERY *[FIFTH] [] CONTOUR (INDEX CONTOUR) SHALL BE ACCENTUATED AS A HEAVIER LINE THAN THE INTERMEDIATE FOUR. HALF-INTERVAL OR [] FT. SUPPLEMENTAL CONTOURS SHALL BE ADDED AS DESIGNATED. LABELING OR NUMBERING OF CONTOURS SHALL BE PLACED SO THE ELEVATIONS ARE READILY DISCERNIBLE. LABELING OF INTERMEDIATE CONTOURS MAY BE REQUIRED IN AREAS OF LOW RELIEF.

(1) TURNING POINTS THAT DEFINE DRAINAGE CHANNELS, DITCHES, ETC., SHALL BE CONSISTENT IN DEPICTING CORRECT ALIGNMENT AND DIRECTION OF DRAINAGE.

(2) SPOT ELEVATIONS SHALL BE ESTABLISHED AND SHOWN ON THE MAPS AT WATER SURFACES ON SHORELINES OF LAKES, RESERVOIRS, PONDS, AND THE LIKE; HIGH AND LOW POINTS AT HILLTOPS AND DEPRESSIONS; AT INTERSECTIONS AND ALONG CENTER LINES OF STREETS AND, WHERE APPLICABLE, TOP CURB AND GUTTER; AT TOPS AND BOTTOMS OF VERTICAL WALLS AND OTHER STRUCTURES; AND AT CENTER LINE OF END OF BRIDGES. GROUND SPOT ELEVATIONS SHALL SUFFICIENTLY SUPPLEMENT CONTOURED ELEVATIONS AND SHALL NOT EXCEED *[] IN. AT TARGET SCALE. SPOT ELEVATIONS SHOWN ON THE MAP SHEETS SHALL BE ACCURATE TO [] DESIGNATED CONTOUR INTERVAL.

(3) DIGITAL TERRAIN MODEL (DTM) GENERATION. DIGITAL ELEVATION MODELS (DEM) SHALL BE GENERATED BY *[GRID, TRACE METHODS] CONTROLLING METHODS ON A NETWORK OF RANDOM POINTS SUPPLEMENTED WITH BREAK-LINE POINTS TO PROPERLY ESTABLISH THE TERRAIN MODEL. CONTOURS WILL BE GENERATED USING STANDARD DTM/CADD APPLICATION SOFTWARE.

b. PLANIMETRIC FEATURE DATA DETAILING. THE MAPS SHALL CONTAIN ALL PLANIMETRIC FEATURES ENCOUNTERED WITHIN THE PROJECT LIMITS AND COMPATIBLE WITH THE TYPE OF PROJECT INVOLVED (I.E., MILITARY MASTER PLANNING, ENGINEERING SITE PLAN MAPPING, ETC.) THESE SHALL INCLUDE, BUT NOT BE LIMITED TO, BUILDINGS; ROADS; SEWER SERVICE LINES; UTILITY SYSTEMS, SURFACE AND SUBSURFACE INCLUDING ALL APPURTENANCES, SUCH AS COMMUNICATION, GAS, WATER, FUEL, ELECTRIC, TELEPHONE, OVERHEAD POWER LINES, TRANSMISSION PIPELINES; STORM DRAINAGE FEATURES AND STRUCTURES, BRIDGES, CULVERTS, PIERS, SPILLWAYS, CHANNEL SYSTEMS; TIMBERED AREAS, LANDSCAPES AND INDIVIDUAL TREES THAT ARE RECOGNIZED AS SUCH; RECREATION AREAS; CEMETERIES; *[], ETC. *[FEATURES/UTILITIES SHALL BE SKETCHED IN DETAIL AND SHOWN ON A SEPARATE SHEET OR, WHERE APPLICABLE, SHOWN ON THE MAP SHEET(S) PROPERLY INDEXED IN RELATION TO LOCATION].

(1) *SURFACE UTILITY DATA. LOCATE AND IDENTIFY ALL CULVERTS (PIPES OR BOX DRAINS); WATER SYSTEMS INCLUDING VALVES AND METERS; CATCH BASIN INLETS AND OUTLETS; MANHOLES

(STORM, SANITARY, TELEPHONE, GAS, ELECTRIC); METER/VALVE BOXES; OVERHEAD POWER POLE LOCATION AND TYPE; LOW WIRE HEIGHTS; OVERHEAD TOWERS; AND TRANSFORMERS. OBTAIN PHOTOGRAPHS AND/OR SKETCHES AS DESIGNATED. *[SPECIFY UTILITY DETAIL REQUIREMENTS, SKETCHES, DETAIL SHEETS, ETC.]

(2) *SUBSURFACE UTILITY DATA. FOR DESIGNATED SUBSURFACE UTILITIES, SHOW ALL SYSTEMS AND APPURTENANCES. PROVIDE PIPE/CONDUIT ALIGNMENT, TYPE, SIZE, *[SUBSURFACE PROFILE], JUNCTION POINTS, ETC.; OBTAIN TOP AND INVERT ELEVATIONS OF ALL [].

(3) *HIGHWAYS, ROADS, AND STREETS. OBTAIN NAMES, DESCRIPTIONS, CLASSIFICATIONS; CENTER-LINE PROFILES OR SECTIONS AS DESIGNATED; ROUTE CLASSIFICATION; PAVEMENT WIDTH AND TYPE AND CONDITION OF SURFACE. WHERE DESIGNATED, SHOW CURB AND GUTTER AND JOINT LAYOUT FOR CONCRETE PAVEMENT.

(4) *BRIDGES AND CULVERTS. OBTAIN DIMENSIONS AND STRUCTURAL TYPE AND CONDITION; MEASURE DECK, FLOW LINE, AND CLEARANCE ELEVATIONS; HORIZONTAL CLEARANCES BETWEEN ABUTMENTS AND PIERS, IF ANY; AND WIDTH OF PIERS. INCLUDE DETAILED PLAN AND ELEVATION SKETCHES, OBTAIN PHOTOGRAPHS UPSTREAM AND DOWNSTREAM.

(5) *BUILDINGS AND PERTINENT STRUCTURES. OBTAIN PROPER NAMES OF ALL BUILDINGS OR LANDMARKS; PROPER NAMES, INSTALLATION NUMBERING, AND/OR DESCRIPTIONS OF ALL BUILDINGS AND OTHER STRUCTURES AFFECTED OR POSSIBLY AFFECTED BY THE PROJECT; FOUNDATION AND FIRST-FLOOR ELEVATIONS OF THOSE STRUCTURES WITHIN DESIGNATED LIMITS AND/OR ELEVATIONS BELOW [] FT; BASEMENT ELEVATIONS; SEWER/DRAIN OUTLET INFORMATION BELOW ELEVATION []. OBTAIN PHOTOGRAPHS OF BUILDINGS AND STRUCTURES.

(6) *LOCATE AND SHOW TYPE, SIZE, AND APPROXIMATE NUMBER OF TREES PER *[] SQUARE FEET OF AREA AS REQUIRED TO PROPERLY ACCESS CLEARING REQUIREMENTS. ACCURATELY LOCATE AND DESCRIBE ALL SCATTERED, INDIVIDUAL TREES IN EXCESS OF *[] IN. DIAMETER.

NOTE: Describe any special requirements for detailed drawings. Add to and elaborate on any of the above instructions on feature detail or utility data as required to properly develop a utility plan and that which may be critical to the particular project, especially if relocation work is to be performed. Specify any areas where planimetric/utility feature detail is especially important, or where it may be deemphasized. Also specify any requirements for field verification of utilities vs. taken from as-built plans.

C.5.3 FINAL SITE PLAN MAPS AND/OR DIGITAL DATA CONTENTS.

a. COORDINATE GRID. UNLESS OTHERWISE SPECIFIED, THE GRID SYSTEM SHALL BE ESTABLISHED ON THE LOCAL STATE PLANE COORDINATE SYSTEM (SPCS) *[UNIVERSAL TRANSVERSE MERCATOR (UTM). GRID TICKS SHALL BE PLACED ON THE MAP SHEETS AT FIVE (5) INCH INTERVALS WITH COORDINATE VALUES PROPERLY ANNOTATED AND SHOWN AT THE TOP AND RIGHT EDGE OF EACH MAP SHEET.

b. ALL HORIZONTAL AND VERTICAL CONTROLS SHALL BE PLOTTED ON THE MAP TO AN ACCURACY OF *[] RELATIVE TO THEIR TRUE POSITION. PRIMARY CONTROL SET TO CONTROL CONSTRUCTION PHASES SHALL BE LABELED AS SUCH.

c. MULTIPLE MAP SHEETS SHALL CONTAIN AN INDEX OF THE SHEET LAYOUT ORIENTED *[NORTH] [] TO EACH SHEET. MATCH LINES/MATCH GRID SHALL BE PROVIDED AND PROPERLY LABELED SUCH THAT EACH SHEET MAY BE JOINED ACCURATELY TO ADJACENT SHEETS.

d. SYMBOLOGY USED ON THE MAP SHEETS SHALL BE IN ACCORDANCE WITH CADD A/E/C STANDARDS.

e. THE TITLE BLOCK, SHEET INDEX, AND LEGEND SHALL BE PLACED ON THE MAP SHEETS TO THE DESIGNATED SIZE AND ARRANGEMENT PER CADD A/E/C STANDARDS. THE TITLE BLOCK SHALL INCLUDE THE NAME OF THE CONTRACTING AGENCY, PROJECT NAME, DATE, SCALE, AND NAME OF THE CONTRACTOR PERFORMING THE WORK. THE TITLE BLOCK CONTENTS *[SHEET INDEX REQUIREMENTS][LEGEND REQUIREMENTS] WILL BE FURNISHED TO THE CONTRACTOR. *[THE

CONTRACTOR'S NAME/ADDRESS, CONTRACT/DELIVERY ORDER NUMBER, AND LOGO WILL BE PLACED ON EACH MAP SHEET] *[ADD APPLICABLE PROFESSIONAL CERTIFICATION REQUIREMENTS].

f. ALL DESIGN FILES WITH SUPPORTING DATA SHALL BE FURNISHED ON TRANSFERABLE MEDIA. THE FORMAT SPECIFIED WILL BE DEPENDENT ON THE OPERATING SYSTEM OF THE DESIGN WORKSTATION [DXF][DGN] OTHER.

g. COMPLETED MAPS, REPRODUCTIONS, COMPILATION DATA, DIGITAL DATA SHALL BE DELIVERED IN ACCORDANCE WITH THE WORK ORDER REQUIREMENTS.

C.6 QUALITY CONTROL AND ASSURANCE STANDARDS.

C.6.1. CONTRACTOR QUALITY CONTROL.

a. GENERAL. ALL FINAL MAPPING DATA SUBMITTED UNDER THIS CONTRACT SHALL CONFORM TO THE ACCURACY STANDARDS OUTLINED IN EM 1110-1-1005 UNLESS MODIFIED OR SUPPLEMENTED BELOW. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL INTERNAL QUALITY CONTROL FUNCTIONS FOR ALL PHASES OF THE WORK AS REQUIRED TO ASSURE THE COMPLETENESS AND ACCURACY OF FINAL COMPILED MAPS.

b. MATERIALS. ALL MATERIALS, SUPPLIES, OR ARTICLES REQUIRED FOR WORK THAT ARE NOT COVERED HEREIN, OR BY WORK ORDER SPECIFICATIONS, SHALL BE STANDARD PRODUCTS OF REPUTABLE MANUFACTURERS, AND ENTIRELY SUITABLE FOR THE INTENDED PURPOSE. UNLESS OTHERWISE SPECIFIED, THEY SHALL BE NEW AND UNUSED AND SUBJECT TO THE APPROVAL OF THE CONTRACTING OFFICER.

c. METHODS FOR EVALUATING MAP ACCURACY. ALL MAPS COMPILED SHALL BE SUBJECT TO MAP TESTING BY THE GOVERNMENT, BY INDEPENDENT THIRD-PARTY FORCES, OR BY CONTRACTOR FORCES WORKING UNDER DIRECT GOVERNMENT REVIEW, TO ENSURE THAT THEY COMPLY WITH THE APPLICABLE ACCURACY REQUIREMENTS STATED IN THE CONTRACT. THE MAP TEST RESULTS WILL BE STATISTICALLY EVALUATED RELATIVE TO THE DEFINED ACCURACY CRITERIA, AND PASS/FAIL DETERMINATION MADE ACCORDINGLY. THE DECISION OF WHETHER OR NOT TO PERFORM RIGID MAP TESTING ON ANY PROJECT, DELIVERY ORDER, OR PORTION OF A PROJECT RESTS WITH THE CONTRACTING OFFICER. IN ALL CASES, THE CONTRACTOR WILL BE ADVISED IN WRITING WHEN SUCH ACTION WILL BE TAKEN.

NOTE: Specify and reference the map accuracy standard and accompanying testing criteria required. The ASPRS standard is recommended for USACE large-scale mapping work. Alternatively, standards set forth in EM 1110-1-1005 or, if applicable, contained in other EMs may be used and simply referenced in this contract.

NOTE: For fixed-scope contracts, indicate the degree of formal map testing contemplated, and by whom. If performed by contractor survey forces, allow adequate field survey time in Section B. On IDC contracts, formal map accuracy tests are optional for each delivery order. The need for map tests is a function of the ultimate or intended use of the maps.

C.7 SUBMITTAL REQUIREMENTS.

C.7.1. SUBMITTAL SCHEDULE. THE COMPLETED WORK, MAPS, AND REPORTS SHALL BE DELIVERED WITHIN *[DAYS AFTER NOTICE TO PROCEED IS ISSUED] *[BY CALENDAR DATE].

NOTE: Include a more detailed submittal schedule breakdown if applicable to the project. Note any preliminary, priority, or partial delivery requirements, with reference to specific Section B line items.

C.8 PROGRESS SCHEDULES AND WRITTEN REPORTS.

C.8.1. *PREWORK CONFERENCE/IN-PROGRESS REVIEW CONFERENCES.

NOTE: Detail any requirements for prework or in-progress review conferences, including requirements for preparing written reports for such conferences.

SECTION D--CONTRACT ADMINISTRATION DATA

SECTION E--SPECIAL CONTRACT REQUIREMENTS

SECTION F--CONTRACT CLAUSES

**SECTION G
LIST OF ATTACHMENTS**

G.1 U.S. ARMY CORPS OF ENGINEERS EM 1110-1-1005. THIS REFERENCE IS ATTACHED TO AND MADE PART OF THIS CONTRACT.

NOTE: List any other attachments called for in contract Section C or in other contract sections. This may include such items as:

- a. Marked-up exhibits, project sketches/drawings.
- b. Station/Monument descriptions or Recovery Notes.
- c. Drafting Standards.
- d. Applicable CADD/GIS Technology Center Standards.

**SECTION H
REPRESENTATIONS, CERTIFICATIONS, AND OTHER STATEMENTS OF OFFERERS**

**SECTION I
INSTRUCTIONS, CONDITIONS, AND NOTICES TO OFFERERS**
